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TELEPHONE ENGINEER and Management

"THE NATIONAL TELEPHONE MAGAZINE"

DECEMBER, 1944

featuring –

RATE MAKING PROCEDURE FOR INDEPENDENT COMPANIES
By
VERNE E. CHANEY

•

EDITORIAL INDEX—Page 7

•

THE COVER PICTURE

WACs operate the famous Paris Militaire switchboard, the communications center which connects this headquarters with all military installations on the continent. Because of their experience with American, British, French and German equipment, they call themselves the "International Operators."

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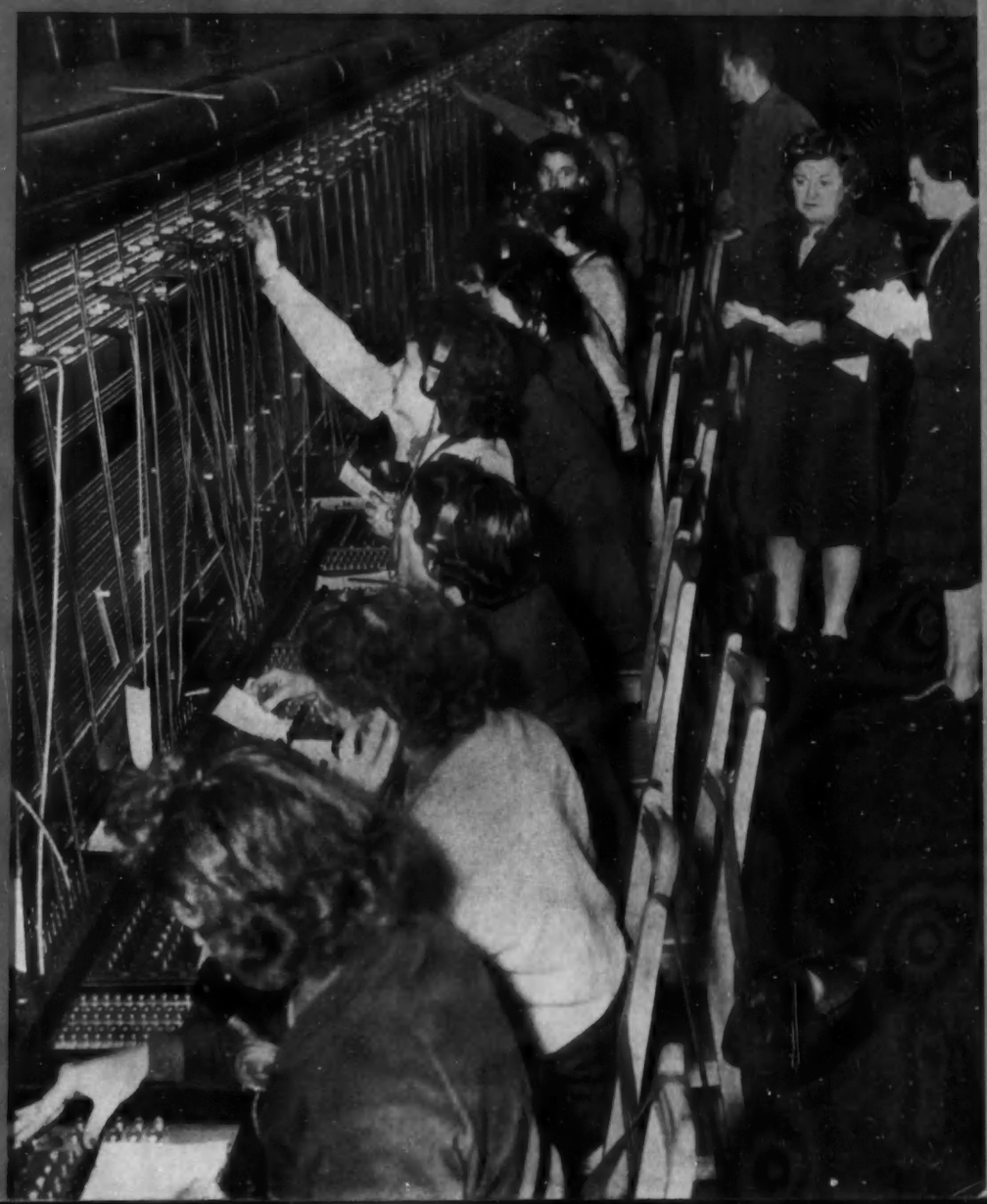

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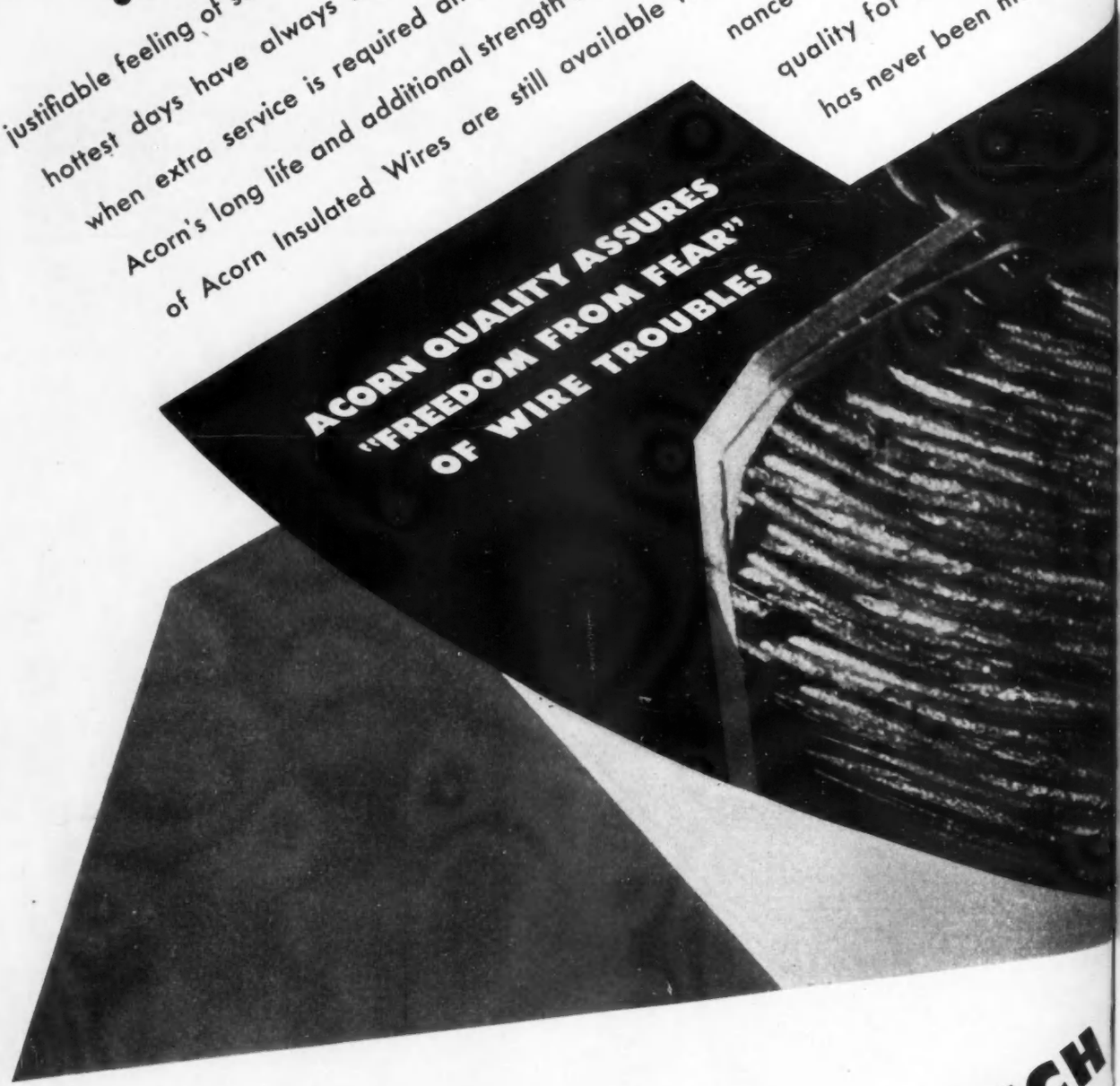

LEICH

At long last we have ended our search for an outstanding article on rate procedure. In our mail through the years the increasing need for information on rate making procedure was emphasized. We suggested various books on the subject, but in most cases these were insufficient. It remained for V. E. Chaney to supply an understandable discussion especially written for Independent telephone companies. On page 25 you will find our "exclusive" management article for this issue. It is "must" reading to every Independent manager or owner.

▼

While we are discussing these exclusive TELEPHONE ENGINEER & MANAGEMENT articles that have been appearing in our columns this year, we want to thank the industry collectively for their letters of commendation received. We in turn pass them on to the outstanding Independent telephone executives who prepared the articles for us and for the industry. We would like to have your reaction to the current article by Mr. Chaney.

▼

The entire staff joins me in extending our thoughts to you for a Happy Holiday Season. The New Year holds much promise that many of our loved ones will have returned before our next Christmas message is printed.—R. W. S.

TELEPHONE ENGINEER AND MANAGEMENT

VOL. 48. No. 12 DECEMBER, 1944

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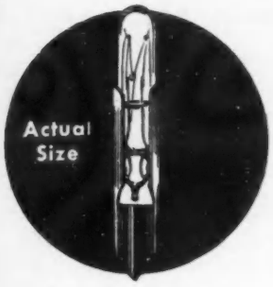

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6B–2	6	.270	.310	2	250
8A–2	8	.080	.100	9	250
8B–2	8	.100	.120	7	320
10A–2	10	.100	.120	9	190
10B–2	10	.240	.260	4.5	560
12A–2	12	.090	.110	12	295
15A–2	15	.090	.110	15	275
16A–2	16	.090	.110	16	340
16B–2	16	.270	.310	5	610
18A–2	18	.035	.050	46	165
18B–2	18	.090	.110	18	350
20A–2	20	.060	.085	27	365
20B–2	20	.090	.110	20	355
24B–2	24	.035	.050	61	140
24C–2	24	.060	.085	33	535
24D–2	24	.090	.110	24	610
30A–2	30	.060	.085	41	670
30B–2	30	.090	.110	30	490
35A–2	35	.035	.050	89	300
35B–2	35	.060	.085	48	645
35C–2	35	.090	.110	35	445
40A–2	40	.060	.085	55	425
44A–2	44	.060	.085	61	630
48A–2	48	.060	.085	66	625
48B–2	48	.090	.110	48	600
48C–2	48	.032	.038	185	145
55B–2	55	.090	.110	55	440
55C–2	55	.045	.055	104	425
60A–2	60	.045	.055	113	525

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LETTERS

from TELEPHONE ENGINEER readers

Gentlemen:

The writer has been engaged in the preparation of telephone directories for Independent companies in the Southeastern States since 1933.

I have seen copies of your magazine and "Blue Book" in their offices and feel that I must be missing some valuable information in the issues that I don't see.

Please accept my subscription to TELEPHONE ENGINEER & MANAGEMENT for one year.

Yours very truly,

E. J. Stenseth
Telephone Directory Service
749 Eden Terrace
Rock Hill, South Carolina

◆

Dear Sir:

I am today sending you my subscription to TELEPHONE ENGINEER: I have enjoyed reading it very much and I think that it is one of the best. I have to say this—that I get a lot of informaion out of it in regard to my work.

Yours very truly,
Henry Twillmann
Ferguson 21, Missouri

◆

Gentlemen:

I have read TELEPHONE ENGINEER & MANAGEMENT for years and only recently subscribed in order that I might see it much sooner because delays in circulating copies through a large organization often resulted in time lags of several weeks. Your timely articles on all subjects are most interesting and informative.

Keep up the good work and congratulations on a fine job.

Sincerely,

Lyman M. Trask
Eng. of P.B.X. Equipment
So. New England Tel. Co.
New Haven, Conn.

◆

Gentlemen:

Do we have a right to buy reconditioned telephones?

Yours truly,

Fred Alexander
Fairview Ind. Telephone Co.
RFD No. 1
Tonawanda, Pennsylvania

(Editor's Note: You most certainly do.)

Rate Making Procedure....

FOR INDEPENDENT COMPANIES

Rate making and its procedure is possibly the most important subject before the smaller telephone companies at this time. Mr. Chaney, in his exclusive article written for this publication, outlines many helpful suggestions to follow on rate procedure. We consider it one of the finest on the subject that has appeared in recent years. No reprint, please, without written permission.

By V. E. CHANEY,

IN dealing with the question of rate making in the telephone industry, it can be said that there is no fixed mathematical or other formula that can be used in determining a fair rate of return or the rates to be charged telephone subscribers for telephone service. The procedure to be followed in adjusting telephone rates involves the interpretation of the utility statutes of the several states by the courts and the commissions. The statutes of the several states dealing with this question are, for the most part, lacking in uniformity. The interpretations of the statutes and court decisions seem to change from time to time depending on the most popular political philosophy of rate making prevailing at the time.

In 1898, the U. S. Supreme Court in SMYTH v. AMES (169 U. S. 466, 42 L.ed 819) itemized what it considered the essentials in the determination of the fair value of a public utility. Since that time, thought on the subject progressed until reproduction cost appeared to be the dominant factor in the computation of a rate base. In recent years, these principles have been disputed to such an extent that, subsequent to the decision of the Supreme Court in the HOPE NATURAL GAS case (320 U. S. 591), critics of the SMYTH v. AMES case contended that the decision in the Hope case "laid the ghost of Smyth vs. Ames." Apparently, that court will now look only to what it considers the end result, namely, whether or not the rates fixed result in confiscation. In rate proceedings, the Supreme Court will no doubt take the position that any result is proper, no matter how reached, unless the utility can clearly prove that the result is confiscatory. Regardless of the apparent confusion that exists and the various bases and procedures that are required to be recognized by the statutes of the several states, they generally, at least in practice, appear to revert to basic principles and that is the utility is entitled to a fair rate of return on the fair value of property used and useful in rendering serice to the public.

If there is any difficulty in arriving at a fair value or a fair rate of return, it will no doubt arise out of the question as to what is fair. So long as the human element of judgment is involved, there will always be differences of opinion as to what is fair and equitable under the circumstances.

A TELEPHONE company may be able to prove to a regulatory body the need for additional revenues and develop a rate that will provide an adequate rate of return, but in some instances such a rate may be prohibitive from the standpoint of public acceptance. Many companies wait too long in bringing about an adjustment in rates which may result in the amount of the increase creating too much of a shock at one time. If we are to wait until

THE AUTHOR

Verne E. Chaney is the executive in charge of the Gary Group telephone operating companies located in 17 states. A telephone man of 34 years' experience, Mr. Chaney qualifies as an outstanding Independent telephone man to write on the subject of Rate Making for Independent companies. The contents of his article are timely, well prepared and, in our opinion, could be used almost as textbook procedure. (This article is one of a series of executive articles authored by outstanding men in the Independent telephone industry.—Ed.)

present rates are confiscatory, it will have a tendency to require a rate that makes it difficult of public acceptance. This, of course, should be avoided if possible. Here again the exercising of good judgment is involved as to the determination of the maximum rate that could be applied at a given time, without reaching a point of diminishing return. Most regulatory bodies are willing to cooperate with management in determining the proper rate that would be accepted by the public in such cases.

In general, the telephone industry cannot be charged with having in effect burdensome or excessive rates. If anything, the small exchange service rates in most communities are too low, especially when the need for revenues to extend the lines and keep them in good repair is considered. The small exchanges, owned by the larger companies, serving rural communities have in general been subsidized for years in part at least, by the revenue from toll lines and the larger exchange operations. There should be no particular objection to this subsidy so long as the circumstances in individual cases permit and the overall earning position is adequate. The independent companies, operating small exchanges are for the most part required to stand on their own feet and, for this reason, the rates are in many cases greater by way of comparison than the rates of similar sized exchanges where an element of subsidy exists. Many regulatory bodies have failed to recognize this situation when comparing rates. Many of the larger companies, having large exchange and toll operations, have been able to give a fairly good account of themselves on their overall operations under present conditions.

THERE was a time when the level of rates for the small independent exchange was less than those of a similar size where the element of a subsidy exists; however, with rising wage costs many independent exchanges found it necessary to increase their rates to a level where they were greater than the rates that were subsidized. This condition had to come about and will no doubt continue if the small exchange expects to be able to continue to operate.

The owners of the smaller exchanges are presently better off than they were a few years ago, from the standpoint of gross revenues; however, the improvement in the revenues has been largely consumed or wiped out by increased taxes and wages. Their rate of return is too low as a class; and when the war is over, their gross income will no doubt revert to their former levels; and they may thus find themselves with an all time high level of operating costs. These higher operating costs are made up principally of wages with a minimum fixed by law as well as other uncontrollable expenditures. With the average Independent telephone company you cannot push the expense valve down very much without seriously affecting the net income, thereby affecting its ability to continue to operate and give the grade of service required by the public. The greatest single item of expense in the operation of the aver-

age telephone line is labor, with taxes and depreciation running a close second. There is only one source of income for a telephone exchange, and that is the revenue it receives from its subscribers.

In the early days of the telephone business when basic patents expired, there was a grand rush to install telephone systems in communities and in rural areas not then served. Competition in many localities also resulted. Frequently such systems were organized as cooperatives. Little consideration was given at the time to the accruing depreciation as an item of operating expenses. Many Independent companies and cooperatives operated on an eight to twelve hour service basis. They thought they were doing very well until they had to replace the property that was worn out in public service. Many of the cooperatives have since fallen by the wayside for the want of adequate revenues to cover depreciation and expenses and are today, one by one, going out of business and they will continue to do so until adequate revenues are obtained to properly carry on this method of operation. Most of the cooperative systems have of necessity been taken over by the nearest exchange owners.

THE small Independent operators must remove any existing fear of increasing their rates to a level that will permit perpetuation and extension of their operations, continuation of good service to the public and the returning of a reasonable profit to the owners. This fear under present conditions, in part, is because of the intervention by the O. P. A. On the other hand, there may be some doubt as to the owners' ability to properly present their case to their state regulatory body.

In the early days, service was rendered at a charge of a dollar or less a month and operators' wages at the small exchanges were five to ten cents an hour. How times have changed, and perhaps rightfully so. In many cases, the owner of the small exchange was the plantman; his wife operated the switchboard, and they took as their compensation that which was left after paying for material and other expenses. In many Independent telephone exchanges, there still remain rates that have not been changed in fifteen to twenty years and in some cases more. Many subscribers look upon rates for telephone service as they would the price of a loaf of bread and many do not understand why the rates should change. Regulatory bodies have generally changed their old time yardsticks as to what the rates should be. Rates required to produce a fair rate of return under present conditions cannot be held down because of comparison with other rates that may be inadequate. Maybe a part of the present difficulty can be attributed to the fact that telephone rates initially established early in the history of the business were too low. Perhaps telephone rates should have been originally established at a higher level, then the public would today have a different yardstick. On the other hand, a higher rate may have retarded the early development. Who knows? The R. E. A. got off to a good start as they had the benefit of many years of experience by other companies. The minimum R. E. A. rate in some cases is $3.00 or more per month, depending on the circumstances involved. It was a new service to the farmer and he had no measurement of value or yardstick. In many cases, he pays $100 to $150 installation costs. If every new subscriber in this country paid this much to install telephone service, they would be shocked beyond recovery. To establish a new yardstick in terms of telephone rates now, with present labor costs, means a great deal of educational work. In Japan before the war, the privilege of having a telephone was traded on the markets for as high as $800 or more.

Let me say at the outset, that during my experience in rate making, involving companies in many states, I have found that the personnel of the regulatotry bodies is generally reasonable and sympathetic in considering the revenue needs of telephone companies. However, I do not want to lead you to believe that the regulatory bodies have not taken good care of the public when rates required adjustment.

In my opinion, any increase in telephone exchange rates requires selling the need for such increase to the public. Sell it to the mayor, the council, the city attorney, the newspaper editor and the business men. If it cannot be sold, the management has fallen down or the people in the community do not want to be sold. Do not get the idea that utility laws are promulgated entirely for your protection or that regulatory bodies are going to do the job for you. When you apply for an increased rate, there are many things you can do to make it easier for them to help you. The regulatory bodies are created by law to hear and study your case and see that your interest, as well as the public interest, is properly protected. Courts should only be resorted to in case the regulatory bodies fail to properly recognize your needs.

WHEN presenting facts and figures in support of an application to be made to regulatory bodies for a rate adjustment, one should not be lulled into the belief that the facts and figures as you prepare them will all be accepted as being factual. Some of the figures will represent indisputable facts and some will represent items of a controversial nature, because the element of judgment is involved. Some of the controversial items, by way of illustration, are: The reproduction value of the property; the present condition of the property; the amount of the original cost of the property, especially where the use of estimates is involved; the proper allowance for depreciation, and the method of determining the amount of income taxes to be allowed.

To bring about an adjustment in rates, certain information and showings must be presented to the regulatory body. An inventory and appraisal on a reproduction cost new basis is commonly used by most companies as forming a basis of determining present value. Some regulatory bodies require an original cost study to be used as one of the elements of value. Cash working capital, material and supplies, as well as going concern values, are also considered as values in arriving at a rate base. Some companies use the equivalent of six weeks' operating expenses, exclusive of depreciation and taxes, for the purpose of determining the working capital needed. Material and supplies for this purpose are often arrived at by using warehouse inventory values of usable material, and in multiple exchange operations a prorate is used to allocate such values to the exchange involved. In some cases, the amount of material needed to be carried on hand for the operation of the property is used. Most regulatory bodies have their own method of arriving at working capital, material and supplies; however, any appreciable differences can always be argued at the time the evidence is submitted by the company and by the regulatory body.

AS to the allowance of growing concern value as a part of the rate base, the courts and commissions seem to be generally in agreement that there is such an item of additional value in a going concern over and above the bare bones value of the property upon which a utility is entitled to earn. Still there seems to be no uniform opinion of the method to be followed in determining the amount of that value as the U. S. Supreme Court said in the NATURAL GAS PIPE-

LINE case (63 U. S. 736, 86 L.ed 699), "Whether there is going concern value in any case depends upon the financial history of the business." In some instances, a percentage has been allowed on depreciated reproduction cost, in others of reproduction cost new, while in other instances, a percentage of fair value has been allowed. Generally speaking, however, the courts and commissions have taken the attitude that no separate additional item will be allowed for going concern value based upon hypothetical circumstances. If, however, the actual circumstances of the particular company involved indicate that going concern value, in its various elements, was not included in the computation of the cost of the physical plant, or reflected in expenses during the period of development of the property, then an additional separate item for going concern value should be allowed in the rate base to the extent proven by the circumstances in the particular case.

When an inventory is prepared, adequate field notes should be prepared in a manner so as to enable the engineers of the regulatory body to locate and check quantities and identify the units of property. Unit costs should also be developed in such a manner that they can be explained to the regulatory body.

In determining the value of the plant of an exchange, where the company operates more than one exchange, due recognition should be given to buildings, vehicles and other equipment that may be used in common. A prorate method is commonly used.

A statement of revenues and expenses should be furnished showing the results of present operations, as well as a proforma statement reflecting the operating results after giving effect to the additional revenue to be realized from the proposed rates. In the development of the proforma income statement, due recognition should be given to any adjustment for past wage increases not fully reflected on an annual basis in the book income figures. When increasing rates, the management should also give consideration to the reflection of any other increases in wages to be made effective, as well as taxes or other expense adjustments resulting from such wage or other adjustments. Such statement should also include the legal, engineering, accounting or other expense incident to the rate case. The aggregate amount of such costs could be allocated on a three or five year basis, depending on the circumstances. If it is thought that wages will continue to rise and that you will be forced to again increase rates, then a shorter spread of the rate costs should be used.

Convention Dates

Texas Telephone Association, Hotel Baker, Dallas, March 12 and 13, 1945.

Kansas Telephone Association, Kansan Hotel, Topeka, March 15 and 16, 1945.

Kentucky Telephone Association, Lafayette Hotel, Lexington, March 20 and 21, 1945.

Iowa Telephone Association, Hotel Ft. Des Moines, Des Moines, April 3 and 4, 1945.

Nebraska Telephone Association, Hotel Lincoln, Lincoln, April 5 and 6, 1945.

United States Independent Telephone Association Executives' Conference, Edgewater Beach Hotel, Chicago, April 10 and 11, 1945.

Illinois Telephone Association, Hotel Pere Marquette, Peoria, April 19 and 20, 1945.

Ohio Telephone Association, Hotel Deshler-Wallick, Columbus, April 24 and 25, 1945.

Pennsylvania Telephone Association, Hotel Lawrence, Erie, May 22, 23 and 24, 1945.

It is also customary to present a statement showing the classes of service rendered with the present monthly rates and the extended annual revenue along with the proposed monthly rates and the estimated resulting annual revenue. From this statement, the amount of the increase in the annual revenues can be determined. From the estimated annual increase in revenue, a deduction may be claimed for any loss in revenue that may be expected as a result of regrades or loss in subscribers because of such increased rates. Whether or not such a loss in revenue is likely to be realized depends upon the result of the selling effort and public resistance to such an increase, as well as upon economic conditions. Experience indicates that if the increase in rates is made necessary because of a conversion to a new type of service or other improvements and the need for such changes was adequately sold to the public, or if the change was made because of a public demand, only a small loss, if any at all, might be expected.

In preparing the income statement, a proper allowance should be made for depreciation as an allowable item of expense. In many cases, the books may not reflect the proper allowance. It goes without saying that the item of depreciation includes obsolescence and inadequacy. The rates of depreciation applicable to the various classes of depreciable property are no doubt one of the most controversial items of expense. In determining the class rates of depreciation, due regard should be given to the character of the units of property. We know that in most localities untreated poles require a higher rate of depreciation as compared to treated poles. The same is true of iron wire as compared to copper wire. The composite depreciation rate for the average small telephone exchange having large amounts invested in open wire plant is much higher than one having a large investment in buildings, underground conduits and cable. Therefore, it is important to develop class rates of depreciation to be applied so as to determine the proper annual allowance for this purpose.

If the management proposes any conversions or other plant improvements in connection with the rate adjustment, an appropriate exhibit should be prepared which will in substance show the present values, the gross expenditures for such improvements, the values of the plant to be retired and the values that will prevail after completion of the improvement project. Any such improvement in the plant will serve to raise the per cent condition of the property thereby increasing the rate base. This exhibit should be developed on the basis of the property subaccounts in order that the changed values can be readily visualized by the regulatory body.

In the event a company desires to adjust the rates at one of several exchanges, it should apply the income tax rates to the income of that exchange regardless of the losses or profits that may prevail at other exchanges. If the deduction for income taxes is determined in this manner, the exchange involved would not be penalized with the taxes on the profits of other exchanges. Neither would it benefit by borrowing a portion of the loss of others. In the event the company as a whole has interest on indebtedness or corporate tax credits or other deductions, an equitable prorate to the exchange should be used in determining the amount of the income tax to be included in the statement. Experience indicates a lack of uniformity

(Please turn to page 64)

On December 8 Democratic Senator Lister Hill (Ala.) introduced S. 2213 to create a Rural Telephone Administration. For your records we are reproducing in full the text of the bill on these pages. (Comments on the bill are carried in Mr. Davies column on page 38.)

RURAL TELEPHONE ADMINISTRATION BILL INTRODUCED

S. 2213

IN THE SENATE OF THE UNITED STATES

DECEMBER 8 (legislative day, November 21), 1944 Mr. HILL introduced the following bill; which was read twice and referred to the Committee on Agriculture and Forestry.

A BILL

To provide for rural telephones, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of providing the benefits of local and Nation-wide telephone service to persons in rural areas there is hereby created and established an agency of the United States, to be known as the Rural Telephone Administration, all of the powers of which shall be exercised by an Administrator, who shall be appointed by the President, by and with the advice and consent of the Senate, for a term of ten years, and who shall receive a salary of $10,000 per year. This Act may be cited as the Rural Telephone Act of 1944.

SEC. 2. The Administrator is authorized and empowered to make loans in the several States and Territories of the United States for the purpose of providing or improving telephone service to persons in rural areas as hereinafter provided, to make, or cause to be made, studies, investigations, and reports concerning the condition and progress of the providing of adequate telephone service to rural areas in the several States and Territories, to publish and disseminate information with respect thereto, to provide managerial, engineering, and legal assistance to borrowers in order to facilitate the attainment of the purpose of this Act, and to institute, intervene, or otherwise participate in any proceedings before local, State, or Federal agencies or courts affecting the rendition by borrowers of adequate service, including proceedings involving the establishment and operation of the new or improved telephone service for which loans are made, the interconnection of the telephone facilities for which loans are made with those of other telephone companies, the charges or divisions of charges applicable to the interchange of traffic over interconnected facilities, and the rates for telephone service to rural users.

SEC. 3. (a). The Reconstruction Finance Corporation is hereby authorized and directed to make loans to the Administrator, upon his request, not exceeding in aggregate amount $50,000,000 or the fiscal year ending June 30, 1945, and for each fiscal year thereafter as the Congress may, from time to time, determine to be necessary, with interest at the rate of 1¾ per centum per annum upon the security of the obligations of borrowers from the Administrator appointed pursuant to the provisions of this Act: Provided, That no such loan shall be in an amount exceeding 85 per centum of the principal amount outstanding of the obligations constituting the security therefor: And provided further, That such obligations incurred for the purpose of financing the rehabilitation, construction, and operation of rural telephone lines, or systems, shall be fully amortized over a period not to exceed thirty-five years.

Photo at the recent S. Car. Convention. L to R: J. A. Raffield, T. Carter Thomasson, retiring president, and W. D. Wilkinson, retiring secy.-treas.

The Administrator is hereby authorized to make all such endorsements, to execute all such instruments, and to do all such acts and things as shall be necessary to effect the valid transfer and assignment to the Reconstruction Finance Corporation of all such obligations. The amount of the notes, bonds, debentures, and other such obligations which the Reconstruction Finance Corporation is authorized and empowered to issue and to have outstanding at any one time under existing law is hereby increased by an amount sufficient to carry out the provisions hereof.

(b) There is hereby authorized to be appropriated to the Administrator out of any money in the Treasury not otherwise appropriated for the fiscal year ending June 30, 1945, the sum of $50,000,000, for the purposes of this Act as hereinafter provided.

(c) Fifty per centum of the annual sums herein made available or appropriated for the purposes of this Act shall be allotted yearly by the Administrator for loans in the several States in the proportion which the number of their farms not then receiving telephone service bears to the total number of farms of the United States not then receiving such service: Provided, however, that at least 20 per centum of the sums allotted yearly to each State shall be made available for loans to telephone companies whose total subscribers are less than one thousand. The Administrator shall, within ninety days after the beginning of each fiscal year, determine for each State and for the United States the number of farms not then receiving such service.

(d) The remaining 50 per centum of such annual sums shall be available for loans in the several States and Territories, without allotments as hereinabove provided, in such amounts for each State and Territory as, in the opinion of the Administrator, may be sufficiently employed for the purposes of this Act, and to carry out the provisions of section 6: Provided, however, That not more than 10 per centum of said unallotted annual sums may be employed in any one State, or in all of the Territories.

(e) If any part of the annual sums made available for the purposes of this Act shall not be loaned or obligated during the fiscal year for which such sums are made available, such unemployed or unobligated sums shall be available for loans by the Administrator in the following year or years without allotment: Provided, however, that not more than 10 per centum of said sums may be employed in any one State or in all of the Territories.

(f) All moneys representing payments of principal and interest on loans made by the Administrator under this Act shall be covered into the Treasury as miscellaneous receipts, except that any such moneys representing payments of principal and interest on obligations constituting the security for loans made by the Reconstruction Finance Corporation to the Administrator shall be paid to the Reconstruction Finance Corporation in payment for such loans.

SEC. 4. The Administrator is authorized and empowered, from the sums hereinbefore authorized, to make loans to persons, corporations, States, Territories, and subdivisions and agencies thereof, municipalities, people's utility districts and cooperative, nonprofit, or limited-dividend associations or mutuals organized under the laws of any State or Territory of the United States, and to the Rural Electrification Administration, for the purpose of financing the construction, acquisition, extention, expansion, rehabilitation, modernization, and operation of telephone systems, exchanges, line, or other facilities for furnishing telephone service to persons in rural areas who are not receiving telephone service or for the improvement and betterment of existing telephone service to persons in rural areas: Provided, however, that the Administrator in making such loans, shall give preference to States, Territories, and subdivisions and agencies thereof, municipalities, people's utility districts, and existing cooperative, nonprofit or limited-dividend associations or mutuals, persons and corporations operating telephone systems through which service is rendered to a total of not more than ten thousand subscribers, the projects of which comply with the requirements of this Act. Such loans shall be on such terms and conditions relating to the expenditure of the moneys loaned and the security therefor as the Administrator shall determine and may be made payable in whole or in part out of income: Provided, however, that all such loans shall be self-liquidating within a period of not to

At the S. C. registration desk: Frank S. Barnes and Howard O. Leinard. In charge of desk, L to R: Mrs. E. T. McElveen, Miss Blanche Timmons, Mrs. Virginia Aycock, all of S. C. Continental Telephone Co.

exceed thirty-five years, and shall bear interest at the rate of 1¾ per centum per anum: Provided, further, that loans under this section shall not be made unless the Administrator finds and certifies that in his judgment the security therefor is reasonably adequate and such loan will be repaid within the time agreed. The Administrator shall, insofar as possible, obtain assurance that the telephone service proposed will be made available to the widest possible number of rural users at rates which are within the users' ability to pay.

SEC. 5. For the purpose of administering this Act and for the purpose of making the studies, investigations, publications, and reports herein provided for, there is hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, the sum of $2,500,000 per annum except for the first fiscal year ending June 30, 1945, the sum of $1,000,000 is hereby authorized to be appropriated.

SEC. 6. The Administrator is authorized and empowered to bid for and purchase at any foreclosure or other sale, or otherwise acquire, property pledged or mortgaged to secure any loan made pursuant to this Act; to pay the purchase price and any costs and expenses incurred in connection therewith from the sums authorized in section 3 of this Act; to accept title to any property so purchased or acquired in the name of the United States of America; to operate or lease such property for such period as may be deemed necessary or advisable to protect the investment therein, but not to exceed five years after the acquisition thereof; and to sell such property so purchased or acquired, upon such terms and for such consideration as the Administrator shall determine to be reasonable.

No borrower of funds under section 4 shall, without the approval of the Administrator, sell or dispose of its property, rights, or franchises, acquired under the provisions of this Act, until any loan obtained from the Rural Telephone Administration, including all interest and charges, shall have been paid.

SEC. 7. This Act shall be administered entirely on a nonpartisan basis, and in the appointment of officials, the selection of employees, and in the promotion of any such officials or employees, no political test or qualification shall be permitted or given consideration, but all such appointments and promotions shall be given and made on the basis of merit and efficiency. If the Administrator herein provided for is found by the President of the United States to be guilty of a violation of this section, he shall be removed from office by the President, and any appointee or selection of officials or employees made by the Administrator who is found guilty of a violation of this Act shall be removed by the Administrator.

SEC. 8. The Administrator shall present annually to the Congress not later than the 20th day of January in each year a full report of his activities under this Act.

SEC. 9. The Administrator is authorized and empowered to extend the time of payment of interest or principal of any loans made by the Administrator pursuant to this Act: Provided, however, That with respect to any loan made under section 4, the payment of interest or principal shall not be extended more than five years after such payment shall have become due: And provided further, That the provisions of this section shall not apply to any obligations or to the security therefor which may be held by the Reconstruction Finance Corporation under the provisions of section 3.

SEC. 10. As used in this Act, the term "rural area" shall be deemed to mean any area of the United States including cities, villages, or boroughs except those having a population in excess of ten thousand, and such terms shall be deemed to include both the farm and nonfarm population thereof; the term "farm" shall be deemed to mean a farm as defined in the publications of the Bureau of Census. The term "person" shall be deemed to mean any natural person, firm, corporation, or association; the term "Territory" shall be deemed to include insular possession of the United States; the term "telephone service" shall be deemed to include service to telephone subscribers by the use of point-to-point radio stations.

SEC. 11. If any provision of this Act, or the application thereof to any person or circumstances, is held invalid, the remainder of the Act and the application of such provision to other persons or circumstances shall not be affected thereby.

W. F. Sloan Leaves WPB To Resume Consulting Practice

William F. Sloan, chief of the equipment production section of the WPB Communications Division since April, 1943, is leaving the WPB Jan. 1 to resume his consulting engineering practice in Chicago.

Because both Mr. Sloan and his partner in the consulting engineering firm, Maynard A. Cook, have served with the WPB for the past three years, Mr. Sloan feels that the increase in business of his concern, together with a completion of all the major tasks in his WPB assignment, necessitates his return to his firm. Mr. Cook will remain with the WPB Division and is now acting in the capacity of the division's deputy director.

William F. Sloan

During his service as chief of the equipment production section which he took over when that unit was created, Mr. Sloan has worked most closely with the Army and Navy in assisting the expediting of military wire communications production and deliveries. He has been particularly valuable in eliminating bottlenecks on critical components. One of the major accomplishments of his section has been the approval of the Russian Lend-Lease wire and telephone equipment purchases from the standpoint of WPB priority sanctions.

Another departure from the Communications Division on Jan. 1 is that of Alfred W. Peterson, Toll Specialist in its Operating Section, who will join Automatic Electric. Mr. Peterson was formerly with the International Telephone & Telegraph Corporation in Puerto Rico for eight years, holding the posts of chief engineer and manager successively during the latter part of his career.

EDITORIAL

A Matter of Management

IN this issue we publish as one of our exclusive management features an article by Mr. V. E. Chaney on the procedures of rate making for telephone exchange service. It will be apparent to any reader that Mr. Chaney speaks on the subject from a wealth of experience.

Telephone exchange rate making is an intricate, time-consuming and tedious job. There is not, nor can there be, any fixed formula for making such rates. No two exchange rate cases are precisely alike. In every one there must be considered in detail the particular circumstances applying to that particular exchange.

The procedures for doing this are important. They are very necessary for a proper presentation by the company of its case. That is why we think a careful reading of Mr. Chaney's article will be helpful to many Independent companies.

Independent telephone managements are often reluctant to ask for higher exchange rates, even when such rates are badly needed, and when it would even be advantageous to the public—from the standpoint of the maintenance of good telephone service—that they be made effective. One reason for this is that a rate case is such a tedious job, and a task that is so different from the day-by-day job of running the business.

Obtaining and maintaining adequate and proper exchange rates are, however, as much a matter of management as is anything else having to do with the running of the business. It is probably a more important matter of management than most of the other things that are done, day in and day out, in the business. If the rates are not adequate, no method of management and no amount of hard work on the part of those in charge can make the business successful.

Some companies are apparently reluctant to present their case for higher rates because they fear the displeasure of their state commission. We think this is wholly unfounded. One of the important reasons for the existence of the commissions is to determine and fix fair and proper utility rates.

THE commissions are prepared to carry on the hearings, conferences or other activities necessary on their part for the determination of rates. They are charged as much with the duty of seeing that utility rates are adequate from the standpoint of the utility company, as of seeing that they are not exorbitant. The proposition of fixing rates is entirely impersonal with them. They are there for the purpose of dealing with the matter whenever asked to do so either by the company or by the public or—if they feel that existing rates are too high—then upon their own initiative.

We think the attitude of the commissions is, generally, that if the management of a telephone company believes it needs higher rates, it is the business of the management to bring its case forward and have it considered.

Telephone companies are also sometimes reluctant to ask for higher rates because they fear the displeasure of the public served. The answer to that is to tell the public what it is all about. The American public is usually fair minded and quite willing to pay the price that will give the other fellow a fair profit, provided it is convinced that the price asked is fair.

The point to all this is that the proposition of obtaining and maintaining adequate telephone exchange rates is as much a matter of management as any other managerial function in the business.

It is a different kind of job, of course, than most of the things that are done day-by-day, and it requires some specialized effort and knowledge. An important part of that knowledge is an understanding of the procedures to be followed. Those procedures are, we think, graphically outlined in Mr. Chaney's article.

Telephone Engineer's TRAINING COURSE

☆ ELECTRICAL FUNDAMENTALS FOR THE TELEPHONE MAN ☆

Alternating Current Instruments--Part XV (Section III)

The Oscillograph

THE oscillograph is an instrument used in electrical laboratories and which permits the visual observation of electrical waves. The oscillograph actually traces on a ground glass or fluorescent screen the wave form of the wave which we wish to observe so that we may visually inspect its shape and amplitude.

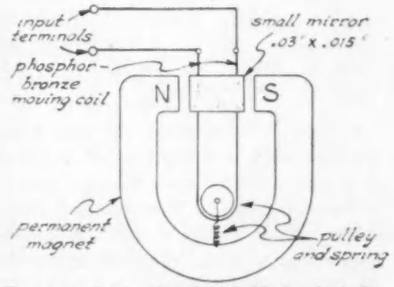

Fig. 78.—Basic Circuit of Mechanical Oscillograph

Oscillographs are used both for direct observation of an electrical wave, and also for making a permanent record of waves on photographic film.

There are two types of oscillographs known respectively as the **mechanical oscillograph** and the **cathode ray oscillograph.** The mechanical oscillograph has a much smaller frequency range than the cathode ray tube, and for this and other reasons has largely been replaced by the latter type, although the mechanical type is still used in certain medical application as for example the electro-cordigraph.

The Mechanical Oscillograph

THERE are several different types of mechanical oscillographs. However, the basic features of the various types are very much the same. The moving coil type will be described. This instrument consists essentially of a **moving coil** comprising a single turn of phosphor-bronze strip suspended between the poles of a powerful electro-magnet as shown in Figure 78. An extremely small mirror (.03" x .015") in size is fastened to the two sides of the single turn as shown.

The ends of the moving coil are terminated on binding posts to which the electrical source whose wave is to be analyzed is connected. The entire element is immersed in oil to dampen its natural period of oscillation.

The coil is so arranged as to have a natural period (resonance) somewhat higher than the highest frequency for which the oscillograph is designed. The natural period varies from 3000 to 10,000 cycles depending on the type of element.

In operation a beam of light radiated by a source such as a small incandescent lamp is focused on the mirror by means of a lens system.

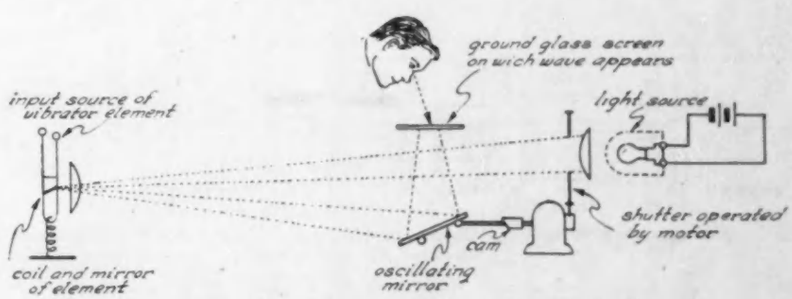

Figure 79.—Sweep Circuit Arrangement for Mechanical Oscillograph.

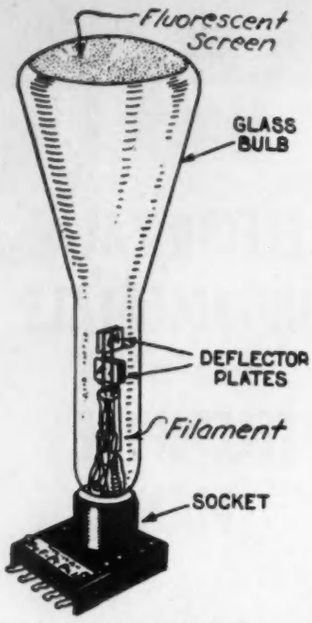

Fig. 79-1.—Cathode Ray Tube Construction (focusing grids not shown)

The source whose wave form is to be studied is connected to the terminals of the moving coil, and the magnetic reaction of the permanent magnet field and the field due to the current from the source cause the coil with attached mirror to vibrate at the same frequency as the source. This vibration of the mirror causes a line of light to be traced back and forth on a ground glass screen or in some cases, a moving photographic film.

Mechanical Sweep Arrangement

IN order to make this line of light trace out the wave form under examination, it is necessary to employ some form of optical or electrical **sweep circuit.** The purpose of the sweep circuit is to provide a linear time axis.

In the mechanical oscillograph the sweep circuit usually takes the form of a rotating or oscillating mirror. An understanding of the action of the sweep circuit in a mechanical oscillograph will be had by considering Figure 79 which shows the arrangement used in one type of Oscillograph.

Referring to the figure, a concentrated light beam is focused on the mirror of the vibrator element. The light striking the mirror is reflected onto a second mirror mounted on a pivot and arranged to oscillate about an axis perpendicular to the beam. The light beam striking the second meter is reflected onto a ground glass screen where it can be seen by the observer. The oscillating mirror is driven by a synchronous motor and cam arrangement in such a manner that the mirror moves forward at a rate approximately the same as the frequency of the source being measured. On the return stroke the mirror travels much facter, and in order to give the illusion of the wave standing still a mechanical shutter also connected to the shaft of a synchronous motor automatically shuts off the light during the return period. From this we can see that if an A. C. source is connected to the input terminals of the vibrator element, that it will move a beam of light across the oscillating mirror and the oscillating mirror will in turn reflect this onto the ground glass so that the wave form may be studied.

If a permanent record of a wave form is desired, the oscillating mirror can be dispensed with and the vibrating light beam from the vibrator element impressed directly on a moving photographic film. In this case the time axis is provided by the movement of the film.

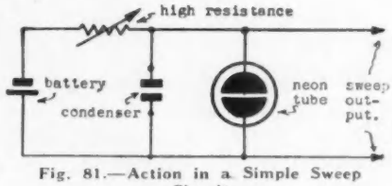

Fig. 81.—Action in a Simple Sweep Circuit

The Cathode Ray Oscillograph

THE Cathode Ray oscillograph is an old invention, but it is only in recent years that it has become a practical and really useful piece of laboratory equipment.

The Cathode Ray oscillograph is quite simple, in fact, in some respects more so than the Mechanical oscillograph.

A complete Cathode Ray oscillograph which will permit viewing waves of different frequencies consists of three essential units, viz: The **Cathode ray tube,** the **sweep circuit,** and the **power supply unit.**

The Cathode ray tube does electronically what the moving coil and mirror in the Mechanical oscillograph do mechanically. The sweep circuit of the Cathode ray tube is electronic in its action. The typical Cathode ray tube consists of an evacuated glass tube as shown in Figure 79-1 having a filament, cathode, grid, two anodes, and two sets of electro-static deflecting plates.

Theory of Operation

THE cathode ray oscilloscope in its simplest form consists essentially of a cathode ray tube, a power supply system to furnish power for the filament, and the two anodes of the tubes, and several potentiometers for controlling the **beam intensity** and **size** of **spot.** The theory of operation is as follows: The cathode of the tube, due to the current flowing in the heater element, emits **negative electrons** in the same manner as any vacuum tube. These negative electrons are attracted toward the positively charged anodes within the tube which are located in front of the cathode. In traveling toward the positively charged anodes, the electrons acquire a high velocity. Due to the velocity obtained, some of the electrons pass through the cylindrical anodes and continue on toward the large flat end of the tube, where they strike the glass. The inside of the glass is coated with certain chemicals (zinc orthosilicate and calcium tungstate) which gives off a brilliant greenish glow at the point where the electrons strike the fluorescent material.

The relative value of the potentials applied to the two positive anodes and to a grid located within the tube serves to focus the beam. That is, these elements are so arranged and have voltages of such values that the beam, instead of tending to spread out as would be its natural tendancy, confines itself to a small diameter beam of electrons, therefore causing the fluorescent glow in only one small spot on the screen. By confining the beam to a small spot it can trace out a fine line on the screen when it is deflected by means of **electrostatic deflection plates** located in a horizontal and in a vertical plane within the tube.

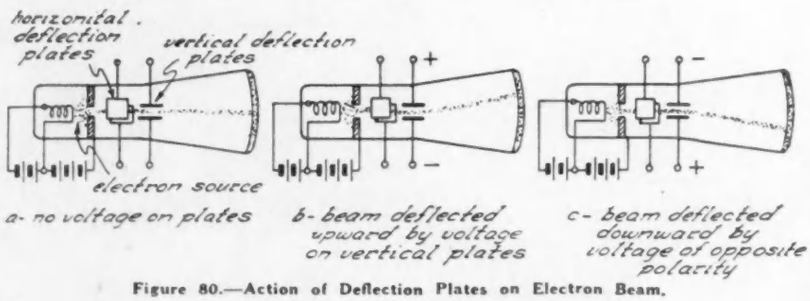
horizontal deflection plates
vertical deflection plates
electron source
a- no voltage on plates
b- beam deflected upward by voltage on vertical plates
c- beam deflected downward by voltage of opposite polarity

Figure 80.—Action of Deflection Plates on Electron Beam.

The Deflection Plates

REFERRING to Figure 80. If a positive potential is applied to one of the deflecting plates and a negative potential to the opposite plate, the beam of electrons traveling toward the end of the tube is attracted toward the positive deflecting plate and repelled from the negative plate. This results because the stream of electrons are negative, and "like" electrostatic charges repel each other and "unlike" charges attract.

The deflection of the beam is proportional to the voltage applied to the deflection plates. Inasmuch as these plates are placed in both a vertical and a horizontal plane, it is apparent from the foregoing description that we can cause the beam to move either vertically or horizontally. If voltages are applied simultaneously to both sets of plates, the beam can be made to move in almost any desired direction on the screen depending on the relative voltages and phase relationship on the two sets of plates.

If we wish to use the tube merely for determining the magnitude of a voltage, we can apply this voltage to one pair of plates (either horizontal or vertical); and the length of the line traced will show the magnitude of an AC voltage; and with DC; the distance the spot moves from its zero voltage position is a measure of the voltage applied.

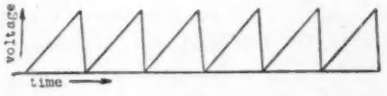

Fig. 82.—Saw Tooth Wave Form of Sweep Circuit

Need for a Sweep Circuit

FOR most uses we are interested in examining **wave form,** that is, to examine the periodic variation which alternating current goes through in each cycle of operation. This requires that we, electronically, sweep the beam of electrons across the screen in a horizontal direction at some fixed frequency which is lower than that of the frequency of the wave form which we are examining. The characteristics of the sweep voltage must be such that it moves the beam across the screen in a linear manner and then quickly "snaps it back" to the starting position, repeating this operation over and over. This requires an additional unit in our oscilloscope, namely a linear saw-toothed sweep circuit. Figure 81 illustrates how a simple sweep circuit operates.

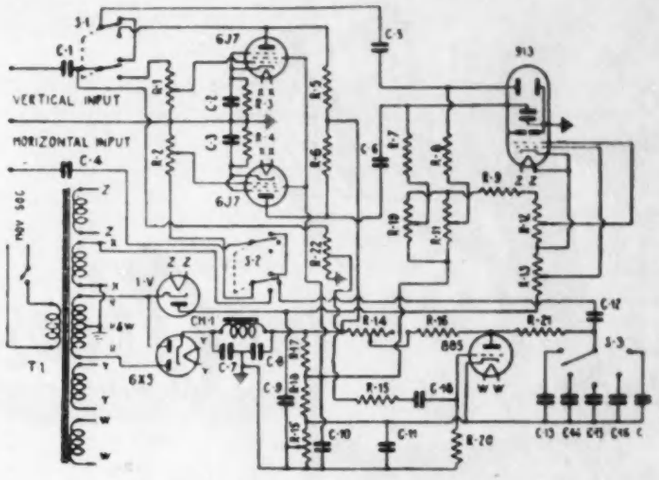

Figure 83.—Complete Circuit of Typical Oscillograph.

The sweep circuit shown consists of an arrangement whereby a condenser is charged through a resistance to a fairly high DC voltage. When the voltage across the condenser has reached some predetermined value, it instantly discharges through a **gaseous discharge tube.** By connecting the horizontal deflection plates, that is the plates which deflect the beam in a horizontal direction across this condenser, we have the linear voltage building up across the condenser and then quickly discharging and giving us a saw-toothed wave form as shown in Figure 82 across these plates which is desirable and necessary in measuring and examining wave form. So much for the general theory of the cathode ray tube.

Analysis of a Typical Oscilloscope Circuit

FAMILIARITY with the more or less complicated circuit of the oscilloscope can best be obtained by segregating the various unit parts of an oscilloscope circuit in much the same way that we would attempt to localize or isolate the trouble in a radio circuit. Let us examine each of the various units in the oscilloscope circuit and study the theory.

Figure 83 illustrates the complete circuit of a typical oscilloscope.

We may consider the complete circuit shown as consisting of the following units: (a) power supply unit, (b) the sweep circuit unit, (c) the amplifier unit, and (d) the cathode ray circuit itself.

The Power Supply Unit

REFERRING to Figure 84 which shows the schematic of the power supply circuit, it can be seen that a single power transformer is used to supply power for the cathode ray tube, the 6-J-7 amplifier tubes, and the 885 sweep circuit tube. A unique circuit arrangement permits a single high voltage winding to supply anode voltage for the cathode ray tube as well as plate voltage for the amplifier and sweep circuit. This is accomplished by the use of two rectifiers, viz., a type 1-V and a 6-X-5 tube.

(Please turn to page 50)

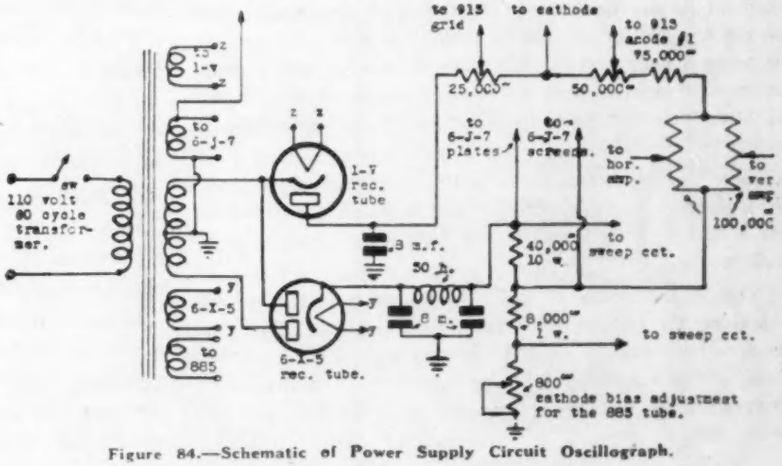

Figure 84.—Schematic of Power Supply Circuit Oscillograph.

Conducted by the
Observer and his Gang

THE Observation Tower

If you have observations or even a friendly bit of argument suitable for use in this column, you are invited to send them along, which automatically makes you a member of the Gang. You will be anonymous—no names of telephone people or telephone companies are used in the column. Address "The Observer", in care of TELEPHONE ENGINEER AND MANAGEMENT.

Let's Be Town Builders!

A GANG Member has told us of some goings on in a little town in which his company operates an exchange—a town of less than 900 population. There may be, in this situation, something of value to all telephone companies operating in small towns.

It seems that, about a year ago, a man showed up in this little town, took a good look around, then leased an old building and started a small foundry. He brought in a few experienced workmen from the outside at first, then he began employing and training local people. The foundry now employs about 60 people. It got its start on war work, but the owner says he now has enough business of a permanent type lined up for peacetime work to keep the business going after the war, and maybe to enlarge it.

Some months after the foundry was established another man showed up, bought a residence, and started a small business in his basement. He manufactures things—such as gaskets, and so on—out of cork. He now employes six or seven people and he, too, says he has enough postwar business in sight to keep his business going. After the war he intends to put up a building for his business, and to employ more people.

These two businesses came to this little town unsolicited, but one result of their establishment is that the city fathers are now trying to locate a few more small businesses in their town.

"They're not trying to make their town a factory town," explained the Gangster who told us about it. "They just want to have enough small businesses located there so that there will be employment for perhaps a few hundred people in varied lines, so that the town will be prosperous and will grow some."

"They figure that with such growth they can have better schools and improve their other civic facilities and thereby have a better town to live in. But they don't want to change the character of the town from that of just a nice country town and a pleasant place in which to live. Pretty smart, I think."

We think it's pretty smart, too.

We sent one of our snoopers to do some investigating of this situation. He says this little town does not seem to have any particular advantages over thousands of other small towns—such as geographical location, transportation, natural resources or raw materials, labor, etc. It is within 100 miles of two large cities, but that apparently had no bearing on the location of these businesses there.

"It's just a nice little town for the owner of the business and the workers to live in," our snooper reported. "That seems to be the reason why these fellows located there."

Here is something to think about: Thousands of small businesses have been started during the war to make things for war. Most of them want to and are going to try to stay in business after the war. Many of them are now located in crowded cities, but could carry on their business just as well—better in some cases—in small towns.

Why shouldn't the local telephone management pioneer in a movement to move some of these little businesses to its small town or towns after the war?

If you're sufficiently interested in the possibilities of such a proposition to write The Observer about it, we'll try to give you a few tips on what we think you and the local authorities of your small town could do to interest some of these small companies in locating in your town.

More And Better Wiring

THREE associations, the National Electrical Manufacturers, National Electrician Contractors and the Edison Institute, have sponsored an organization called the "Adequate Wiring Bureau" which has started a campaign to bring about adequate and better electrical wiring in homes, new and old.

These folks figure that there will be a million new homes built in this country per year, for at least eight years after the war. They want these new homes, and old ones, too, adequately and properly wired, with plenty of well-located outlets in every room to take care of all the electrical appliances that will be available for home use after the war.

Maybe the telephone industry is overlooking something in not giving more attention to the proper wiring—of new homes for telephones. It's easier and cheaper to do the inside wiring for a telephone before the house is finished.

But you know how most people are—they put in the plumbing and the electrical wiring, of course, while the house is being built. But they wait until the day before they move in, to yell for a telephone. Then the telephone company has to fish the wires through and inside the walls, being careful all the time not to mess up the woodwork or the walls.

Couldn't we educate people to remember the telephone wiring before the new house is completed?

Signs of the Times

OUR thanks to Gang Member No. 73, who has sent us two mottoes, or slogans, to add to those we hung on the wall of the Observation Tower last month. One of them is:

BE PREPARED! ANYTHING CAN HAPPEN, AND PROBABLY WILL.

The other, which we've all seen lately in one form or another, is:

THE DIFFICULT WE DO IMMEDIATELY; THE IMPOSSIBLE MAY TAKE A LITTLE LONGER.

If you have a favorite motto or slogan, send it in. We'll print it and, some day, we may be able to squeeze enough money out of the Editor to have some of them printed in size and form suitable for hanging on your own walls.

Add These To The Farm Telephone Problem

THE farm telephone problem seems to be so badly mixed up already that it will probably do no harm if we mix it up a little more.

Here's our contribution to the melee:

The Board of Agricultural Economics, which is, of course, a governmental agency, says the farmers of the nation now have on hand about twelve billion dollars in cash or other liquid assets—and, as the fellow said, that ain't hay!

The Rural Electrification Agency has estimated that each farmer newly connected to electric lines will spend, on the average, $145.00 for wiring and $400.00 for electrical equipment and appliances, and that, in addition 35% of them will install pressure water systems and plumbing at a cost of about $225.00.

We are beginning to wonder why, in the face of all this, anybody should assume that the average farmer is so poor that he cannot pay a fair price for telephone service?

Maybe some of us have got this farm telephone proposition "wrong end to." It could be that we should be doing more talking and thinking about supplying the farmer with good telephone service, at a fair price, rather than supplying him the cheapest possible kind of service, regardless of its quality.

We have a feeling that if the farmer wants any telephone service at all, he wants it to be good, and that it might be—at least in some sections of the country—that the really basic question about farm telephone service is the question of quality rather than that of rates.

If you want to know what we mean, go out to a farm that is on one of those twenty-stations-on-a-line rural lines, and try to carry on a satisfactory telephone conversation; particularly a satisfactory long distance conversation. Then you'll know why the farmer sometimes doesn't care whether he has a telephone or not, regardless of how cheaply he can get it.

Cash And Taxes

ACCORDING to statistics compiled by the United States Independent Telephone Association, Class A and Class B Independent telephone companies had more cash on hand at the end of 1943 than they had ever had before. Including temporary cash investments (such as United States bonds) the 233 A and B Independent companies had cash as of December 31, 1942, of some $32,375,000.

Of course there's a catch in this proposition, as usual. On that same day these companies had taxes accrued and unpaid of something like $22,200,000.

We still think that, as we said last April, if we were managing a small telephone company we would try to put it on a "pay as you go" plan as to Federal taxes, by laying aside, when we had surplus cash, some of it for the purpose of paying taxes when payment time comes.

Merry Christmas!

IT'S jumping the gun, of course, but we have to say it now or not at all, since our next column won't be out until in January. So here it is:

To all Gang Members and all readers of this column—MERRY CHRISTMAS AND A HAPPY NEW YEAR!

That is, as merry a Christmas and as happy a New Year as anyone can have in such a troubled world.

It is our fervent hope and prayer that the new year upon which we are about to embark will bring the end or at least a definite beginning of the end of slaughter and destruction, and the beginning of an era of peace in which mankind can turn to reconstruction, to the succor of the helpless, and to a sane and happier use of the great and wonderful resources for human happiness with which it has been blessed.

Highlights of the Communications News

Important Communications developments of the past month, briefed for busy readers

by

ROLAND C. DAVIES
Editor, Telecommunications Reports

Rural Telephone Administration

THE long-anticipated bill to create a rural telephone administration with an appropriation of $50,000,000 for the remainder of the current fiscal year to June 30, 1945, and an additional $50,000,000 authorization from the Reconstruction Finance Corporation was introduced December 8 by Senator Lister Hill of Alabama, Democratic Whip, but the chances of any action in the waning days of the present Congress, even to the extent of committee hearings, were quite dubious.

The measure (S2213) was referred to the Senate Agricultural Committee, the same committee which drafted the Rural Electrification Administration legislation in 1935.

Senator Hill stated that he intended to push his bill and, because he is the most powerful administration member of the Senate, there might be a slim possibility of hearings at this session by the Agricultural Committe. The latter committee has no regularly scheduled meetings for the remainder of this session, but can be assembled at the call of the chairman, Senator Thomas of Oklahoma. However, it was indicated that, unless Senator Hill insisted on that step, the committee was not planning to function any more except on legislation of signficance to the war effort. As there is absolutely no chance of passage at this session, the measure will have to be reintroduced at the new 79th Congress.

Revealing that he and Gordon Persons, commissioner and president elect of the Alabama Public Service Commission had been working on the legislation for some time, Senator Hill explained that the rural telephone bill would provide for loans to individuals, corporations, state agencies, municipalities and cooperatives or "mutual" telephone companies as well as to the Rural Electrification Administration for the purpose of financing the construction, acquisition, extension or modernization of existing telephone companies, together with providing for the creation, when necessary, of new organizations to operate rural telephone service.

The bill provides that preference be given to municipalities, cooperative organizations, mutual telephone companies and to individuals or corporations who operate existing telephone systems through which service is being rendered to a total of not more than ten thousand subscribers. While this appears to be mainly a means of extending rural service through presently operating telephone companies. The proposed rural telephone administration, it is thought, might authorize loans to municipalities, state agencies, REA cooperatives or cooperatives of the proposed rural telephone administration.

There appears definitely a wedge of government ownership to be created under the legislation, because the bill would establish not only REA cooperatives (semi-federal agencies) but also state agencies and municipal ownership. The telephone industry has had virtually no state owned systems although in the late 30's there were threats of such systems in Pennsylvania and Washington state and there have been only a few municipally operated telephone systems in the central Northwest. The legislation would appear to strike hardest from the standpoint of invasion of government ownership at the independent telephone industry which operates approximately two thirds of the rural telephone service of the United States. It also might be noted that the Hill measure goes beyond the Rural Electrification Act which only extended electric service to rural areas not having such service with the Rural Telephone Administration being empowered to acquire existing telephone companies and to extend and rehabilitate their service.

Under the bill fifty percent of the $100,000,000 would be allotted each year for loans in the several states in proportion to the number of their farms not having telephone service as compared with the total number in the United States. Senator Hill stressed the provision in the measure that at least twenty percent of such sums allotted yearly to each state should be made available to small telephone companies whose total subscribers are less than one thousand. The loans under the bill would be made upon a self liquidating basis for the construction of new lines as well as the modernization of existing systems at

(Please turn to page 67)

Twenty-four employees of The Home Telephone & Telegraph Company of Fort Wayne, Indiana, were honored recently for covering more than a million and a quarter miles without a traffic accident over a period of five years. The recognition ceremonies were held in the company's warehouse and garage building.

Those in the picture are, front row, left to right: Edward Meier, Thomas Shoulders, Frank E. Bohn, president of the company, Harvey Raub, Captain Dunifon, Jacob Simmons and Alan Brumskill; second row, Frank J. Baker, general superintendent of the company, who presided at the ceremonies; Ray Tracy, Lloyd Wire, Frank Robertson, Theodore H. Sanders, Monroe Zumbrun, Bernard Welsh, Clifford Morton, Romeo Walton, Mr. Griffin; third row, Thomas Chandler, William Young, Victor McGuire, Andrew Fosnaugh, Arthur Cranston, Ward Hindsley, Wayne Kepler, and rear row, Thomas Piller, Carl Sautter, Carl Meiboom and Charles Shoppell.

Pleasure still is Ours

It has long been our privilege, at this holiday season, to greet and be greeted by our many good friends in the Telephone Industry. In spite of all the changes in the world about us, this pleasure still is ours.

This year, indeed, we feel a closer bond in the knowledge that your men and ours — brothers, sons, and fellow-workers — are battling side by side in our nation's cause. As we extend the best wishes of the season, may we unite in a pledge that nothing we can do will remain undone, to speed the day when we again can clasp their hands and wish them, too, "A Merry Christmas and a Happy New Year."

AUTOMATIC ELECTRIC COMPANY
Automatic Electric Sales Corporation
International Automatic Electric Corporation

Bob Hedrick (left) presents a cake to Mr. and Mrs. Hunt on their 35th Anniversary celebrated during the Missouri Convention.

MISSOURI CONVENTION REPORT

By RAY W. SMITH, Editor

A WELL planned convention program by the Missouri Telephone Association resulted in heavily attended sessions for that group during its annual convention at Kansas City November 21 and 22. The farm and rural telephone subject received much attention by the speakers. All members of the board and present officers were re-elected.

Association president S. T. Neill, unable to attend because of a serious illness, dispatched a letter of resignation to the convention. By a rising vote the membership refused to accept and unanimously re-elected him to again head the Missouri association. Other officers are: 1st vice president, J. R. Carter, Perry; 2nd vice president, J. M. Roberts, Gallatin; 3rd vice president, John Leader, St. Louis; 4th vice president, W. R. Journey, Higginsville, and secretary treasurer, R. W. Hedrick, Jefferson City.

Directors re-elected were: G. A. Hearne, Warrensburg; Carl L. Spaid, Kansas City; M. J. Stooker, Kansas City, and C. W. Gottry was selected to fill the unexpired term of the late W. N. Curtis, Columbia. Other members are: H. C. Todd, Maryville; F. M. Browne, Kansas City; C. A. Vedder, St. Louis; C. W. Boutin, Cape Girardeau, and Foster B. McHenry, Jefferson City.

Vice president Carter presided at the sessions. A convention sidelight was provided during the banquet on the first evening when Mr. and Mrs. J. O. Kent, owners of the Huntsville Telephone Company, were presented a wedding cake to celebrate their 35th anniversary. We are reproducing a picture of the occasion taken by the Kent's son-in--law, Stanley Green. The cake was presented to the association for the occasion by Raymond Burfiend, prominently known representative of the Automatic Electric Company.

J. C. Crowley Jr., St. Paul, was one of the prominent speakers at the Mo. convention.

In his address to the assembly Mr. Carter outlined the program to follow. His remarks were timely and informative. His synopsis of the plans followed by officers in planning the proceedings was a tribute to R. W (Bob) Hedrick, perennial executive in charge of association headquarters.

J. C. Crowley, secretary of the Minnesota Telephone Association, was the first speaker on the program although the title of his address "A Little of This and That" appeared to this writer as a bit of whimsy. Mr. Crowley traced the history of Independent telephony to the present day before warming to his real subject. His remarks on the farm and rural situation facing the telephone industry were based on actual experience gained from "grass roots" contact and work. In part he said:

"Yes, the small telephone exchange is the problem of the independent companies. (In setting forth these figures, I do not wish to imply that the Bell Company has no small office problems.)

"A further breakdown of these smaller exchanges shows that of the 798 central offices in your state—

158 serve less than 100 telephones.
89 serve from 100 to 150 telephones.
64 serve from 151 to 200 telephones.
44 serve from 200 to 250 telephones.

Total, 355, or approximately 45% of the 798 independent central offices.

"I draw the line at 250 or less stations because it has been my experience that the public more highly appreciates the value of telephone service in exchanges of over 300 stations than in exchanges serving a lesser number.

"An analysis of these conclusions shows that in many of these smaller exchanges,

"First, repairs and replacements are neglected beyond a reasonable time.

"Second, there is a lack of proper accounts and records of service, interruptions or complaints, the elapsed time of such interruptions and the remedy provided.

"Third, the responsibility for management and operation is divided or avoided by those who are supposed to direct the management and operation of such exchanges.

"Fourth, there is a lack of routine inspection of central office equipment and subscribers station apparatus, with a preponderance of broken mouth pieces, loose receiver caps or cracked shells, frayed cords, bent diaphragms in receiver, generators needing oiling and adjustment, telephone directories torn or missing. Any and all of these may be found in these exchanges, much to the annoyance of the subscribers served.

"In short, in the majority of cases there is laxity of proper supervision over maintenance and operation, as well as proper accounting methods.

"As a result of these annoyances to the subscriber, disputes arise as to payments for service. This, in many instances, is the reason for uncollectible accounts, which loss no telephone company can afford."

In offering suggestions as to the relief of conditions in rural areas, Mr. Crowley said:

"I believe the responsibility of improving these conditions falls,

First, upon the executives and management of the larger companies.

Second, upon the public in the communities in which these properties or lines exist, and

Third, upon our regulatory bodies.

"In my opinion, it is the responsibility of every telephone executive, manager and employee of the larger companies to show his interest in pointing out to the people in charge of these smaller exchanges and farm lines the necessity of proper accounting methods. Also, he must show the necessity for accurate records of cable distribution and location as well as records of interruptions to service.

"With the proper system of accounts established, these smaller exchange people will soon learn of the inadequacy of their present rates to cover

Use
AUTELCO
REBUILDING

When employees depart, and manpower shortages prevent proper maintenance of equipment, breakdowns increase. Telephone management is caught in a vicious spiral of *decreasing* maintenance, *increasing* trouble.

If this is YOUR problem, Autelco Rebuilding can help you. Send us your faulty equipment—telephones, switchboard apparatus, or complete switchboard sections. Our factory-trained experts will rebuild it from top to bottom, inside and out, and return it to you in perfect operating condition—ready to function with minimum maintenance attention.

Our experts will be glad to consult with you on a rebuilding program. For many situations, we can supply replacement units to provide service while your own equipment is being rebuilt. Tell us your problem—or ask for a copy of Circular 1640-B, which describes this modern service.

The Mark of Quality in Rebuilding Service

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Originators and Developers of Strowger Step-by-Step Machine Switching Automatic Dial Systems
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Export Distributors: INTERNATIONAL AUTOMATIC ELECTRIC CORPORATION

the cost of service, provide for depreciation and pay a fair return upon the investment."

"After Victory Problems" was the title of the address offered by Shields R. Smith, general manager of the Eastern Missouri and Arkansas area of the Southwestern Bell, St. Louis. He offered several points that are presenting themselves as post-war problems including in these points the improving of farm telephone service. Improvement of service during the period after the war was also stressed. He was particularly anxious that the entire telephone industry use the services of the Telephone Advertising Institute that is now furnishing a complete advertising service to all Independent telephone companies.

Missouri Secretary-Treasurer R. W. (Bob) Hedrick greets his neighbor Herb Couch, secretary of the Kansas Association.

Officers and Executive Committee of the Missouri Telephone Association. Standing left to right: H. C. Todd, Maryville; C. W. Boutin, Cape Girardeau; C. A. Vedder, St. Louis; M. J. Stooker, Kansas City; F. M. Browne, Kansas City; Geo. A. Hearne, Warrensburg; Carl A. Spaid, Kansas City; F. B. McHenry, Jefferson City. Sitting left to right: John Leader, St. Louis; J. M. Roberts, Gallatin; J. R. Carter, Perry; R. W. Hedrick, Jefferson City. Those not present when the picture was taken are: Dr. S. T. Neill, president, Clinton; W. R. Journey, vice president, Higginsville; and C. W. Gottry, member of executive committee, Columbia.

W. C. Ross, chief accountant of the Missouri Public Service Commission, Jefferson City, Mo. gave a talk on "Telephone Accounting and the Public Service Commission."

At this time, Mr. Hedrick, secretary of the association, read a letter of resignation from Dr. S. T. Neill, president. C. W. Boutin, president of the Southeast Missouri Telephone Company, Cape Girardeau, made a motion that this resignation be not accepted, which motion was unanimously carried.

Ernie W. Miller, managing editor of the Olathe Mirror, Olathe, Kansas, was the guest speaker at the banquet. He gave a humorous talk entitled "We're Human—So What."

"The Wage-Hour Law" was discussed by A. K. Purdy, U. S. Department of Labor, Kansas City. Mr. Purdy brought much information of interest to the members and after his talk an open discussion was held.

The presiding officer called on Mr. Carl L. Spaid, president, The United Telephone Company, Kansas City, Missouri, who discussed purposes and functions of joint committee on rural telephone service, United States Independent Telephone Association and Bell system.

"The Advantages of Pension Trust to Telephone Companies" was discussed by E. L. Jenkins, St. Louis, Missouri. W. E. Naylor, general commercial supervisor, Western Light & Telephone Company, Kansas City, Kansas, discussed the Telephone Advertising Institute.

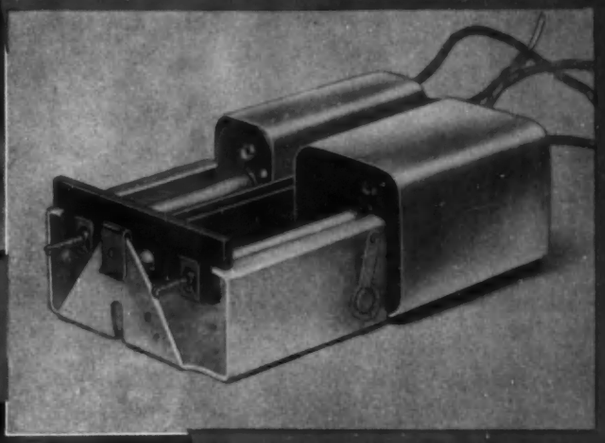
Before adjournment, M. J. Stooker read a resolution relating to the death of Walter N. Curtis, Columbia, who was a member of the Executive Committee. This resolution was adopted.

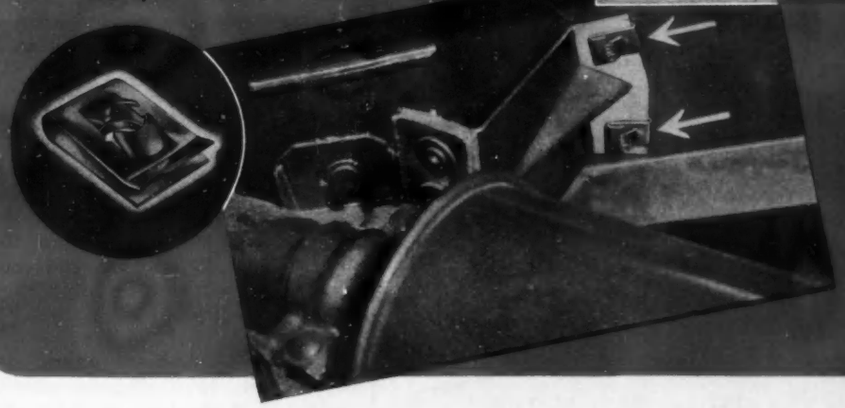
Scene at registration desk during Missouri convention.

THE *Self-Retaining* "U" Type SPEED NUT

SPEEDS UP AND IMPROVES ASSEMBLY OF STOVES, RADIOS AND MOTOR VEHICLES

Self-retained "U" nuts permit blind assembly of stove panels and door liners. They fasten parts securely, yet are resilient enough to prevent enamel damage.





"U" nuts fit over a fibre bracket holding automatic tuning screws. Spring prongs of Speed Nuts provide correct tension to permit adjustment of core screws.

Heavy duty "U" nuts fasten auto muffler bracket to frame. One operator makes complete attachment with power screwdriver, as "U" nuts are self-retained in position.

"U" type SPEED NUTS are easily and quickly applied — just snapped by hand into screw-receiving position — no welding, riveting or clinching necessary. No wonder "U" nuts SPEED UP product assembly!

"U" type SPEED NUTS hold tight — their arched prongs absorbing vibration to prevent loosening. Yet, their resiliency prevents damage to the parts they hold. No wonder "U" nuts IMPROVE the finished product! Available in many shapes and sizes, "U" type SPEED NUTS fit a wide range of thicknesses—metal plastic or glass.

Send us your design details and we'll show you how SPEED NUTS can cut assembly time and cost and improve the quality of your product too. Write today!

TINNERMAN PRODUCTS INC.

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In Canada: **Wallace Barnes Co., Hamilton, Ontario.** ***In England:*** **Simmonds Aerocessories Ltd., London.**

*Speed Nuts** PATENTED

***Trademark Reg. U. S. Patent Office**

FASTEST THING IN FASTENINGS

WHILE YOU'RE "STILL BUILDING ON PAPER"

call in your Graybar man!

THOSE new line structures you contemplate must be "built on paper" *before* they can begin to become realities of wood and metal and glass.

Soon, you will want to begin construction quickly, *as will everyone else,* to add to facilities and relieve long-overburdened lines. So that you may be ready and able to go ahead when the good tidings come, make *your* plans right *now*. Then, when new line construction gets under way, you'll be assured of prompt delivery of the items you prefer — via GRAYBAR.

Right now, your GRAYBAR Man is ready with the latest information on materials and application. There is a GRAYBAR Man near you, ready to make your pole-line supply problems his personal responsibility. Why not take advantage of his time-saving assistance? 5528

GraybaR

GraybaR 75 YEARS OF *Electrical Distribution*

IN OVER 80 PRINCIPAL CITIES

Executive Offices: **GRAYBAR BUILDING, NEW YORK 17, N. Y.**

25 YEARS AGO THIS MONTH

Taken from TELEPHONE ENGINEER files of December, 1919.

PROPOSED rate increases by telephone companies throughout the country are being presented to their state commissions, reports TELEPHONE ENGINEER in December, 1919, and many companies have already been granted justified increases in telephone rates.

★

EUROPEAN telephone practice in the use of aluminum versus copper wire interested all countries because of the war necessity of the Central Empires to find substitute metals when their supply of copper was cut off. Fred W. Scholz contrasted physical and mechanical properties of the two metals for TELEPHONE ENGINEER readers of December, 1919 and presented an instructive, technical discussion of both aluminum and copper wire.

★

ADVERTISING for good will was as much the case in December, 1919, according to TELEPHONE ENGINEER, as now. Advertising was not to sell its goods, for the demand was much greater than the supply; but to establish and continue good will with its public.

★

NICKEL telephone setups, described by L. C. Mahon, district manager at Washington, D. C. for the Chesapeake and Potomac Telephone Company, make it clear just what happens from the time the nickel is deposited in the box of a typical pay-station city. TELEPHONE ENGINEER presented illustrations of the complete procedure back in December, 1919.

★

TELEPHONE ENGINEER predicted in December, 1919 great opportunity for American manufacturers of telephone equipment. All nations were then considering rehabilitation of their systems. Activity was observable not only in every part of the United States, but also in South America, Europe and Asia. "New telephone plants will be springing up in all quarters of the globe, and much of it will be made in the U.S.A."

RAYTHEON RECTICHARGER

Stays on Active Duty

ALL THE TIME!

Day and Night, the Raytheon RectiChargeR never lets up—automatically trickle charging the battery . . . carrying the normal load . . . keeping the battery fully charged. Result — better, uninterrupted telephone service at lower operating cost.

Completely automatic in its operation, the Raytheon RectiChargeR is ideal for unattended locations. Examine only once or twice a year when water is added to the battery.

RECTICHARGER with cover open

Check these Advantages:

- ✔ A Raytheon RectiChargeR and batteries provide an automatic AC-DC power system. RectiChargeRs —
- ✔ Keep batteries fully charged.
- ✔ Prevent overcharge and undercharge.
- ✔ Eliminate voltage variations.
- ✔ Increase battery life as much as 40%.
- ✔ Reduce battery maintenance and inspection to once or twice yearly.
- ✔ Complete range of units — 11/12 and 22/24 cells . . . 1 to 12 amps . . . many models for 50 cycles input.
- ✔ A descriptive bulletin containing facts and diagrams will be sent on request. Write:

The coveted Army-Navy "E", for Excellence in the manufacture of war equipment and tubes, flies over all four Raytheon Plants where over 15,000 men and women are producing for VICTORY.

RAYTHEON
MANUFACTURING COMPANY
190 WILLOW ST., WALTHAM, MASS.

MANUFACTURERS OF VOLTAGE STABILIZERS, RECEIVING AND TRANSMITTING TUBES AND COMPLETE ELECTRONIC EQUIPMENT

Edited
J. S. REED, JR.

LINE and DESK

Q. What method would you recommend for repairing blown tubular fuses such as those used in station protectors?

A. When a quantity of tubular fuses have been accumulated in the storeroom, a good procedure would be as follows: Test the fuses for continuity and sort out broken and badly warped fuses. Buff the fuses on a wire-bristle buffer to remove dirt and paint spots and brighten the metal ferrules on the fuse ends. Open fuses are repaired by drilling out the solder-filled holes in the metal ferrules and "rethreading" the fuses with 7-ampere fuse wire, after which the holes are soldered over, care being taken to insure a perfect bond between the fuse wire and the ferrules. A small electric motor with a drill point of the proper size (about # 30 in the chuck may be used for drilling out the solder, a guide block being utilized to line up the fuse with the drill point. A straight harness leather awl will be found convenient for rethreading the fuses.

Q. Why are telephone circuits not ordinarily permitted on the same pole with power lines of voltages higher than 5,000 volts?

A. The principal reason for not permitting telephone circuits in joint use with power lines carrying more than 5,000 volts is that the metal parts of the average telephone station protector cannot stand the high amperage that would be forced through them by such high voltages in case of a cross between the two types of circuits, and a fire hazard would therefore result.

Q. What is the average insulation resistance of an open wire line?

A. The insulation resistance of open wire lines under various conditions is as follows:

Very dry weather
—500 megohms per mile
Average weather
—25 megohms per mile
Very wet weather
—2 megohms per mile

Q. Under what circumstances is the joint use of poles by telephone and power companies feasible?

A. Joint use of poles by telephone and power companies gives the most satisfactory results in cities and towns. In these populous districts there are many power, street lighting, and telephone circuits, and congestion of streets and alleys would result if these services were carried on separate poles. Since long parallels and higher power voltages occur in rural districts, it is undesirable to utilize joint construction in these locations on account of inductive interference and dangerous exposure to telephone circuits resulting from the close proximity of the power lines. In general, joint construction should be employed when high voltage circuits carried on the same poles with telephone circuits do not exceed 5,000 volts between conductors or 2,900 volts to ground. Series lighting (constant current) wires should not carry more than 7½ amperes, and street railway feeders should not have more than 750 volts to ground. Joint construction should not be undertaken until a mutual agreement as to terms of payment for the use of the poles and other considerations has been reached by the companies involved. In addition, rules in regard to clearances and grades of construction prescribed in the National Electrical Safety Code should be followed.

Q. When paralleling storage batteries, should the individual cells in parallel strings be cross-connected along the strings or should the connection be made at the ends of the strings?

A. The safer practice is to connect the batteries together only at the ends of the strings as shown in Figure 1. When individual cells are cross-connected in the strings and trouble develops in any one cell, the fault may not be detected until the other cells in the cross-connection have been drained by the bad cell to a dangerous extent.

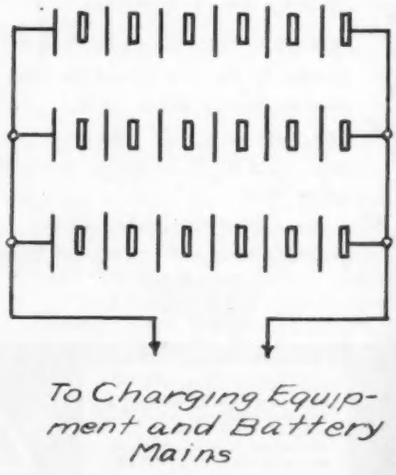

Fig. 1. Correct method of connecting strings of storage cells in a central office battery.

Nazis To Discontinue All Private Telephones

Illustrating the critical situation inside Germany, all private telephones in the Reich, judged unessential for the war effort, will be discontinued during the next few weeks.

Only administration and business telephones and those of Elite Guard and Nazi party members, besides trusted army officers, will be allowed to remain in service, it was reported in a Stockholm newspaper. This step is aimed against home front opposition and further economies in communications personnel and materials, it was said.

Nicholls Made Colonel

Promotion of Lt. Col. Harold C. Nicholls, Omaha, to rank of Colonel has been announced by the Office of the Chief Signal Officer.

Col. Nicholls, formerly metropolitan district manager of Northwestern Bell Telephone Co. in Omaha, has been stationed at the Air Transport Command's Miami Army Air Field since December, 1943, as commanding officer of the Southeast Sector of the Army Communications Service. Under his command are the men who install, engineer and service the radio aids to air navigation used by ATC and other aircraft operating between Miami and China.

Phone Stops Suicides

Work of New York City police in saving the lives of would-be suicides with a new manila rope net is coordinated by a portable telephone which has a 500-foot wire for use on tall buildings. When the net is in place an observer on the street talks by telephone to the men in the building.

No Threat Intended

A midwestern telephone subscriber was surprised and a bit shocked when dismissed by a long distance operator with the threat, "If you will call up, I'll hang you." The operator, new on the job, hastily corrected her mistake by saying, "If you will hang up, I'll call you."

Word From the Front

When Rita Harrigan, Brooklyn Red Cross worker, returned recently from a year of duty over-seas, she began some intensive telephoning. About 200 service men in Italy had asked her to call their wives and parents. Rita made the calls, some as far away as Nebraska.

STROMBERG-CARLSON
RECOMMENDS—

MARK OF STRONG POLES!

DIAMOND C

Mfd. by Colfax Lumber & Creosoting Company, Inc.

For the greatest strength in poles, use COLFAX Creosoted Yellow Pine Poles.

The poles are treated full length under pressure with the finest and cleanest obtainable grade No. 1 Creosote Oil, a pure distillate of coal tar, in accordance with AWPA standards.

Each pole, after being carefully graded according to the physical specifications, is treated with eight pounds of creosote, or more if the customer desires.

COLFAX Creosoted Yellow Pine Poles will assure you the lowest annual pole cost obtainable.

For strength and economy, use

DIAMOND C

Creosoted Yellow Pine Poles

HABIRSHAW

No. 17 Bronze Drop Wire

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Electrical Fundamentals For the Telephone Man

(Continued from page 35)

The use of two separate rectifier tubes rather than a single tube in the power supply circuit is desirable, as it permits grounding the anode, one of the horizontal and one of the vertical deflection plates. It also permits operating the cathode of the 885 tube at approximately ground potential.

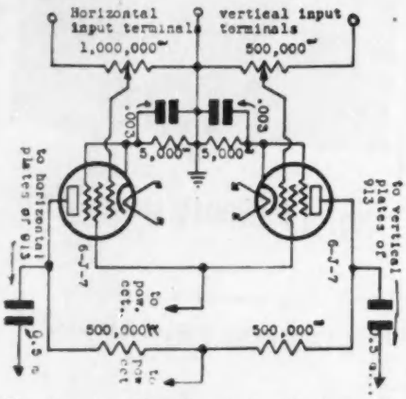

Fig. 86.—Amplifier Circuit for Vertical and Horizontal Deflection Plates

It will be observed that no filter choke is used on the rectifier circuit of the 1-V tube which furnishes anode potential for the cathode ray tube. A single 8 M.F. filter condenser provides adequate filtering, inasmuch as the anode current is very small. A 30-henry choke and two 8 M.F. filtering condensers provide sufficient filtering action in the rectifier circuit of the 6-X-5 to supply plate potential for the 6-J-7 amplifier and the 885 sweep circuit tubes.

The various resistors shown in the power supply schematic are necessary to furnish a voltage dividing arrangement to give the proper voltages at various points in the circuit.

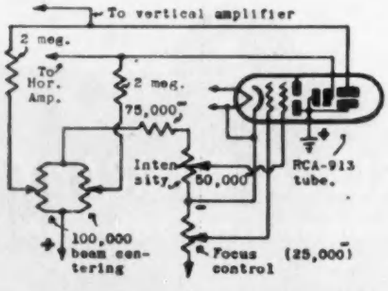

Fig. 87.—Circuit of the Cathode Ray Tube

The Vertical and Horizontal Amplifier Circuit

THE circuit of the amplifier tubes connected in the horizontal and vertical deflection plate circuits are shown schematically in Figure 86. The new 6-J-7 metal pentode type tubes are used. Plate voltage is supplied by the same rectifier as is used to supply the 885 sweep circuit tube. The rectified voltage is fed to the plate through resistors R-5 and R-6, having a value of 500,000 ohms each.

The grid input circuits of the two tubes are connected to potentiometers R-1 and R-2, having values of 500,000 and 1,000,000 ohms respectively. These potentiometers permit adjustment of the grid input voltage to get the desired spread of the beam on the cathode ray screen. The output circuits of the amplifying tubes are connected directly to the horizontal and vertical deflection plates through 0.1 m.f. condensers shown as C_5 and C_6.

Switch S_1 permits connecting the input circuit directly to the vertical plates of the cathode ray tube, when amplification is not desired. Bias for the 6-J-7 amplifying tube is obtained by cathode biasing resistors R-3 and R-4 having values of 5000 ohms each.

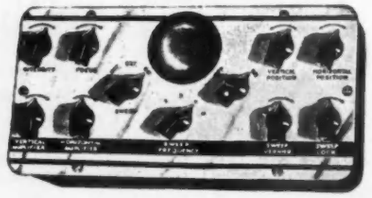

Fig. 88.—Control Panel of Oscillograph

It will be observed that the cathode bypass condenser has a capacity of only .003 microfarads, which is lower than is generally used in a cathode biasing arrangement. It was found that the capacity of the by-pass condenser across the bias resistors should be kept small to avoid distortion of the sweep voltage.

Screen voltage is obtained by a voltage dividing arrangement connected across the output of the 6-X-5 rectifier.

The Cathode Ray Tube Circuit

NEXT, examining the schematic of the cathode ray tube circuit as shown in Figure 87, we find that the high voltage anode and one of the horizontal and one of the vertical deflecting plates are all connected to ground as is also the metal shell of the tube. This is a definite advantage as some circuits which have been suggested for 913 tube are so arranged that the shell is operated at several hundred volts above ground, resulting in a shock hazard if the shell is touched. The method employed in obtaining a high DC voltage for the anode of the 913 tube is unique. It consists of connecting the output voltages of the two rectifier tubes in series. Examination of Figure 84 will show that rectifier tube 1-V operates as a half wave rectifier and being connected across one-half of the high voltage secondary winding charges condenser C_9 to a peak of 350 volts. The additional anode voltage required is obtained by connecting the positive return end of the voltage dividing network (used to get the proper voltages on the cathode, grid, and focusing anode) to the 6-X-5 power supply voltage dividing network at a point which is approximately 100 to 150 volts above ground. This results in 450 to 500 volts on the anode of 913 tube and at the same time permits the anode of this tube to be maintained at ground potential, as are also the cathodes of the 885 (through bias resistors) and the two amplifying tubes.

Voltage Control

REFERRING to the voltage dropping resistors found in the 913 tube power circuit shown in Fig. 87 we note that resistor R-13 is a 25,000 ohm potentiometer and controls the voltage on the grid of the 913 tube. This control can be adjusted to give the proper size spot on the screen. The voltage applied on this grid varies from zero to approximately 90 volts negative for "current cut-off."

Variable potentiometer R-12 has a value of 50,000 ohms and controls the voltage anode No. 1. This control is also used in adjusting the spot for proper brilliancy and size. The voltage on anode No. 1 should be approximately 100 volts positive for proper operation. Potentiometers R-10 and R-11, both having values of 100,000 ohms, provide an adjustable positive potential which applied to the underground horizontal or vertical plates permits centering the spot on the screen. This potential is obtained by utilizing the voltage drop along these potentiometers. Resistor R-7 and R-8 of 2,000,000 ohms each prevent the spot-centering resistor from loading the input circuit of the 913 tube deflection plate.

Circuit Controls

THE controls just discussed in the circuit analysis are shown quite plainly in Figure 88. It will be noted that the intensity control in the upper left-hand corner of the panel is shown as potentiometer R-12 in the circuit diagram. This control affects brilliancy of the spot on the screen by regulating the voltage on anode No. 1. The focusing control is shown on the diagram as potentiometer R-13 and adjust the bias on the grid of the cathode ray tube. In the lower left-hand corner, the amplitude controls for the vertical and horizontal amplifier tubes are shown. These controls regulate the grid input voltage applied to the 6-J-7 amplifier tube.

The switch to the left of the screen is S_2 in the diagram and is for the purpose of connecting the horizontal deflection plates either to the linear sweep circuit or to a source of low-voltage, 60 cycle current obtained from the filament winding on the power transformer.

The rough sweep frequency adjustment is made by selection of any one of five condensers by means of a multipoint switch located directly under the screen. The switch (shown as S_1 in the diagram) to the right of the screen permits connecting the input circuit either directly to the vertical deflection plates or through the 6-J-7 amplifier. In the upper right-hand corner of the panel is located R-10 and R-11 in the circuit diagram, which adjust the beam position on the screen (centering controls). In the lower right-hand corner is shown the control (R-22 in the diagram) which regulates the amount of synchronizing voltage fed back to the 885 sweep circuit tube (synchronizing control). To the left of this control is the sweep vernier potentiometer shown as R-14, which permits a fine adjustment of the sweep frequency.

Figure 89 shows some of the typical patterns which are obtained on the screen of the cathode ray tube when various voltages and phase relationships are established on the two input plates of the tube.

Impedance Measuring Instruments

THERE are two types of Impedance Measuring instruments in use, viz:

1. Laboratory type Impedance bridges which measure inductance and A.C. resistance.
2. Shop type impedance bridges which measure inductance, D.C. resistance, and Capacity.

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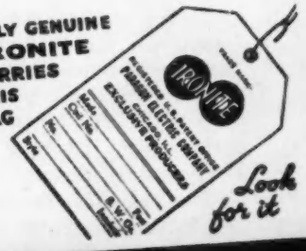

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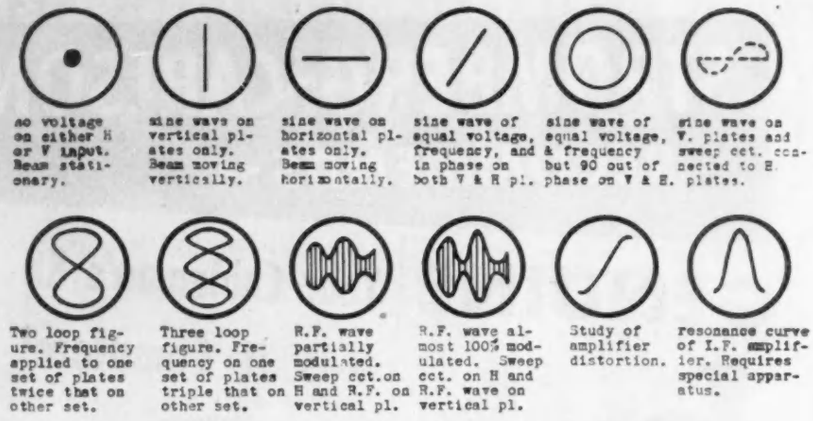
no voltage on either H or V input. Beam stationary.
sine wave on vertical plates only. Beam moving vertically.
sine wave on horizontal plates only. Beam moving horizontally.
sine wave of equal voltage, frequency, and in phase on both V & H pl.
sine wave of equal voltage, & frequency but 90 out of phase on V & H. plates.
sine wave on V. plates and sweep cct. connected to H. plates.
Two loop figure. Frequency applied to one set of plates twice that on other set.
Three loop figure. Frequency on one set of plates triple that on other set.
R.F. wave partially modulated. Sweep cct.on H and R.F. on vertical pl.
R.F. wave almost 100% modulated. Sweep cct. on H and R.F. wave on vertical pl.
Study of amplifier distortion.
resonance curve of I.F. amplifier. Requires special apparatus.

Figure 89.—Typical Pattern Obtained with Various Input Conditions.

In connection with measurements in laboratories and certain types of measurements on telephone lines, an elaborate measuring setup is used consisting of a source of A.C. measuring current of the desired frequency, an Inductometer (a calibrated variable inductance) a decade resistance box, several fixed resistances, and a standard inductance.

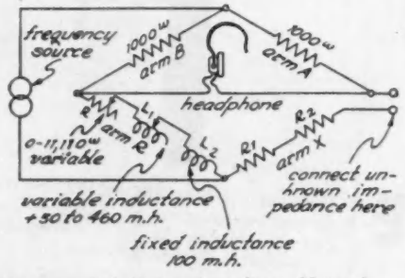

Fig. 90.—Bell System Impedance Measuring Method

These several units are connected in series with the unknown impedance, as shown in Fig. 90. The Inductometer and the Decade resistance box are adjusted until no sound is heard in the headphones which indicates the bridge to be balanced. The inductance and A. C. resistance of the unknown impedance can then be read directly from the setting of the Inductometer and Decade resistance box. The impedance is then determined by the formula.

$$Z = \sqrt{R^2 + X^2}$$

It should be noted that R in the impedance formula is the effective or A.C. resistance and not the ohmic resistance.

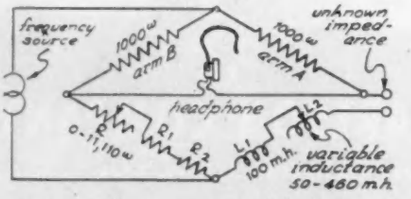

Fig. 91.—Arrangement of Bell System Bridge for Measuring Impedance which is Largely Capacitative

Details of Circuit

THE measurement of impedance with W.E. No. 1-B Bridge is based on the familiar Wheatstone Bridge arrangement. Two of the arms of the Bridge shown as Arm A and B in Figure 90 are non-inductive 1000 ohm resistances. Arm R consists of a variable resistance (0-11,110 ohms) and a fixed inductance L_2 and a variable inductance L_1. The X arm consists of the impedance to be measured and two fixed resistances R_1 and R_2 whose purpose is to compensate or balance the resistance of the two inductances L_1 and L_2. The source of measuring frequency is connected across the junction of the A and B, and R and X arms. An ordinary receiver which is used to determine when the bridge is balanced is connected across the junction of the A and X, and B and R arms.

The range of the bridge is —560 to +560 milli-henries. The actual range of the Inductometer is only +50 to 460 milli-henries. The additional range is obtained by shifting the fixed and variable inductance from the R arm to the X arm of the bridge.

Theory of Operation

THE theory of operation is as follows: Current from the oscillator feeds into the junction of the A and B arms. The variable inductance and resistance is adjusted to give minimum tone in the receiver. Under this condition the current through all four arms will be equal and voltage across the receiver zero.

The unknown impedance will have an inductance (either plus or minus) and an effective resistance equal to the settings of the Inductometer and resistance box. For example, if the settings were X = 100 and R = 200, then the unknown impedance would be:

$$Z = \sqrt{R^2+X^2} = \sqrt{200^2+100^2} = 224 \text{ ohms}$$

Note. The reactance X must be computed from the relationship $X = 2\pi fL$.

If the impedance under measurement is largely capacitative, the variable and fixed inductance are shifted to the X arm of the bridge as shown in Figure 91.

Under this circumstance the inductive reactance of the Inductometer will neutralize the capacitative reactance of the capacity and the setting of the resistance box in the R arm will show the effective resistance of the capacity. The Inductometer reading in millihenries should be considered as negative when it is in the X arm of the bridge. The two resistances R_1 and R_2 are both shifted to the R arm of the bridge to compensate for the resistance of L_1 and L_2 in the X arm.

The capacity can be computed from the relationship.

$$C = \frac{1}{2\pi fX}$$

In commercial bridges the range is extended by inserting fixed inductances of known value in series with the variable inductance, or in the opposite arm from the variable inductance.

Servicing Type Impedance Bridge

IN connection with the servicing of radio and public address equipment a simplified type of impedance bridge is often used. The bridge shown is capable of measuring with fair accuracy inductance, capacity, and D.C. resistance. It should be noted that whereas the impedance bridge previously described is capable of measuring **effective resistance,** the RCA bridge measures only D.C. resistance. For most practical work this does not handicap the application of the bridge materially.

General Features

THIS bridge consists essentially of a variable ratio arm Wheatstone bridge arrangement, and the circuit includes three standards, consisting of inductance, capacity, and resistance. The tone necessary for the bridge operation is obtained from a 1000 cycle vacuum tube oscillator together with a two-stage amplifier. The oscillator and amplifier are operated from an A. C. power supply, which permits the bridge to be operated directly from the 110 volt 60 cycle source. A pair of high impedance radio headphones are used as the usual **null indicator** on the bridge. The unknown resistance, capacity, or inductance to be measured is connected to the two posts

in the upper left hand corner of the panel.

A range selector switch must be set on the range at which the item under measurement is thought to fall. Figure 93 illustrates the range of the universal bridge. It will be observed that it is capable of measuring resistances from 1 ohm to 1,000,000 ohms, and capacities from 10 micro-farads up to 10 microfarads and inductances from 100 micro-henrys up to 10 henrys. These are very useful ranges in radio and electronic servicing work.

Inductance and Capacity Measurement

THE two controls marked **phase** (one of which is merely a vernier of the other) must be adjusted along with the main variable dial for null tone in the headphones. These controls insert resistance in either the standard or X arm of the bridge so as to compensate for the resistance which is present to some extent in all capacitors and inductances. For example, if a coil has an inductance of one henry and a resistance of 25 ohms, in order for the bridge to balance, we must insert 25 ohms (less the

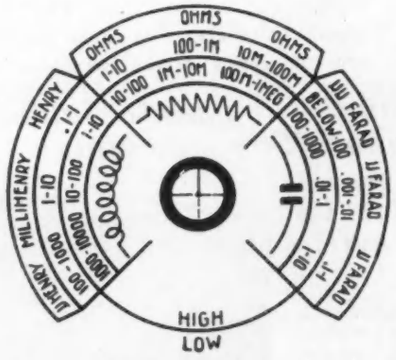

Fig. 93.—Range Selector Switch on RCA Bridge

resistances of the Standard inductance) in series with the standard arm of the bridge. This is done by adjusting the phasing controls until this amount of resistance is cut into the standard arm. This counter-balances the same amount of resistance in the item under measurement; then, when the larger dial is adjusted, we will get null tone at the proper setting on the dial.

Inasmuch as the standard inductances which are used in a bridge have a certain amount of resistance, it is sometimes necessary to insert the phasing controls in series with inductance under test, provided it has a lower D.C. resistance than the standard inductance. A toggle switch on the panel which is marked "to X arm" and "to standard arm" serves to transfer the phasing controls from one arm

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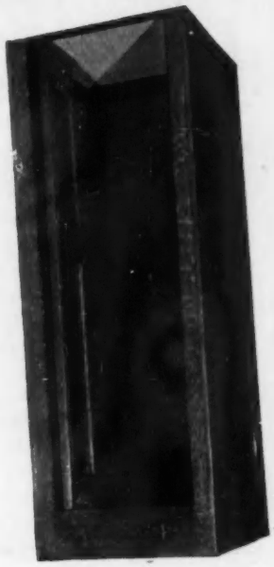

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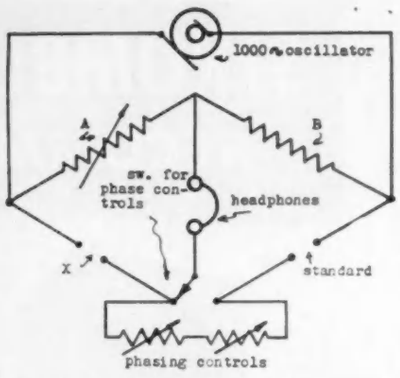

Fig. 94.—Basic Circuit of RCA Universal Bridge

to the other in such cases.

In making resistance measurements, the phasing controls are turned to the "off" position. In making resistance measurements in the range 10,000 to 1 megohm, on certain types of resistors or resistor devices having considerable capacity it may be necessary to adjust the capacity balance control in the lower right-hand corner to counter-balance the item under test when its D.C. resistance is being measured.

Schematic Basic Circuit

FIGURE 94 shows schematically the circuit of the RCA Universal Bridge. Referring to this figure, it will be observed that the main dial is a calibrated variable resistor, shown as A in the figure, and being in the A arm of the Wheatstone bridge arrangement. The standard arm of the bridge consists of a standard capacity, a standard inductance, and a standard resistance, which are selected by means of the range switch, depending upon the type of measurement being made. The X arm of the bridge is, of course, the item under measurement. The B arm of the bridge is a fixed resistance. The two phasing controls, one consisting of a coarse adjustment and the other of a fine adjustment, are so arranged that they can be cut into either the standard or the X arm by means of the switch F.

Theory of Operation

IN operation, current from the 1,000 cycle oscillator passes into the junction of the A and X arms where it divides in proportion to the impedance of the two paths offered and passes on through the other arms of the bridge where it again divides in proportion to the respective impedances of the B and standard arms. **When the impedance of arm A is to the impedance of arm X as the impedance of**

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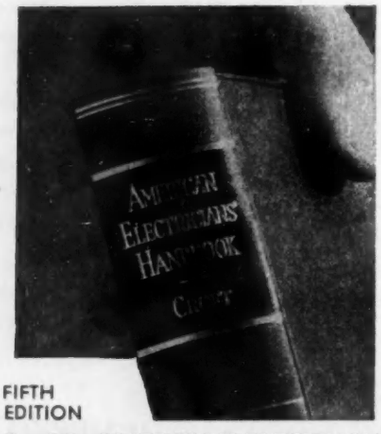

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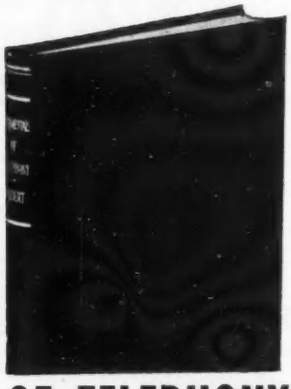

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standard arm, there will be no difference in potential across the headphone and no tone will be heard in the headphone indicating a balance. The reading of dial A will then indicate the impedance of the device connected to the X arm.

The complete circuit of the RCA bridge is shown in Fig. 95.

Electronic Servicing Instruments

ELECTRICAL testing instruments play an important part in the radio, television, and public address servicing field. While the ordinary voltmeter-milliammeter-ohmmeter combination instrument is very popular for servicing work, several other instruments are required for complete servicing. These other instruments are:

1. An R.F. and A.F. oscillator.
2. A radio set analyzer.
3. A chanalyst (or equivalent).

Radio frequency oscillators are essential in radio and television servicing work as a source of A.C. voltage of the proper frequency which is fed into R.F. amplifiers which are then adjusted to give maximum efficiency at the frequency being fed into them. These R.F. oscillators use one or more vacuum tubes connected in an oscillatory circuit which is variable over a wide range by means of a tuning condenser. A typical R.F. oscillator is shown in Fig. 96.

Fig. 96.—Typical RF Oscillator Used in Radio Servicing

Radio Set Analyzer

RADIO set analyzers consist of an arrangement of the several different types of sockets all connected together and to a flexible cable and plug. A number of **pin jacks** are connected to the various leads of the sockets.

The analyzer is used to permit easy and quick measurement of the various voltages and currents present in each vacuum tube of a radio set. The tube is removed from the set and placed in one of the analyzer sockets (several sockets are required because of the different types of tubes and sockets in use.) The plug from the analyzer is placed in the radio set socket from which the tube was removed.

With the radio set in operation the tube in the analyzer receives current through the analyzer cable. The current flowing in the plate, grid, or

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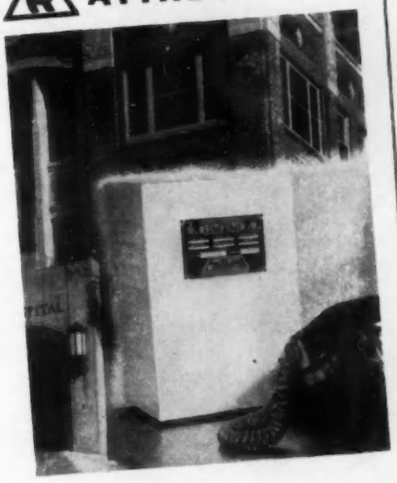

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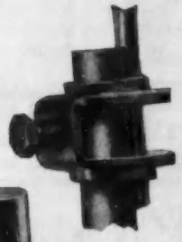
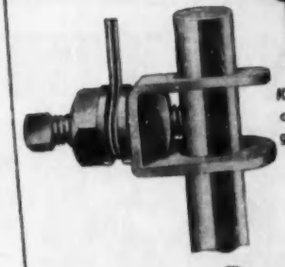
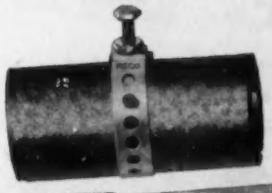
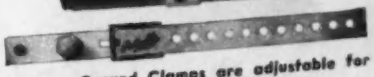


Ground Rod Clamps for ½", ⅝" or ¾" steel or copperweld rods.



Kling Klamp for copper or iron ground wires.





Station Ground Clamps are adjustable for grounding to water pipe.

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STROMBERG-CARLSON COMPANY
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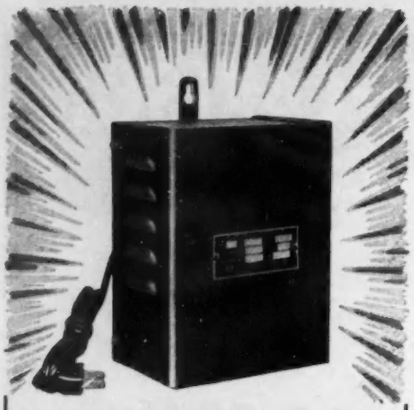

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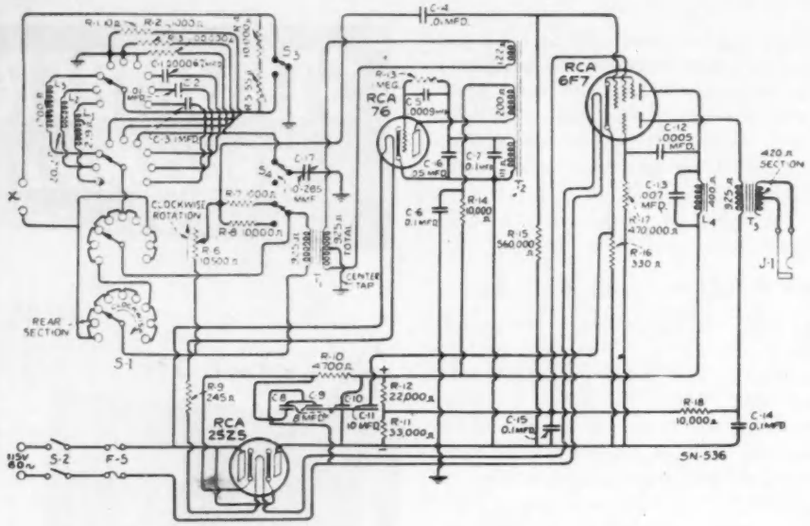

Figure 95—Complete Circuit of RCA Universal Impedance Bridge

cathode circuits, or the voltage across the circuits and ground can be readily determined by connecting a voltmeter or milliammeter in the proper pin jacks.

Figure 97, on page 61 shows a typical analyzer circuit and Figure 98 a commercial analyzer with self-contained volt-ohm milliammeter.

The Chanalyst

THE chanalyst is in reality a vacuum tube voltmeter which can be connected across any part of a radio or television circuit to determine if that portion of the circuit is operating properly. Inasmuch as the R. F. voltage is quite low at the input to a radio set, the chanalyst is equipped with two tuned R.F. amplifiers which when adjusted to the frequency of the signal under test amplify the feeble voltages sufficiently to give a visual indication either on a voltmeter or a tuning eye.

With the chanalyst the signal can be followed through a radio receiver and one can readily locate by means of the resulting indications the exact point at which the signal is held up. Detailed tests can then be conducted at this point rather than checking the entire receiver by the usual point to point testing method. Regardless of whether the receiver is a tuned RF circuit or a superhetrodyne, the same general principles as to the movement of the signal through the receiver exists. Though the path may be long and tedious between the antenna input terminals and the loudspeaker, nevertheless the signal always goes through a similar conversion process for a given type circuit.

General Features of the Chanalyst

THE Chanalyst looks very much like a radio receiver with the exception that it has a great many more controls on its front panel. An illustration of the chanalyst with the various controls designated is given in Figure 100. It consists essentially of several vacuum tube amplifying circuits which feed into diode detectors.

KING TUT
could have checked on the progress of his workers -
O.K.-BOSS!
HOW'S PYRAMID NO. 37?
IF-
he could have reached them over LongLife Drop Wire.
Long Life DROP WIRE
Careful and constant watchfulness of our saturant assures you of highly satisfactory results when using LongLife Drop Wire.
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WB
THE WHITNEY BLAKE CO.
New Haven, Conn.
Well Built wires since 1899

and the output of these detectors is fed into electron tuning eye indicators of the magnitude of the signals tested. These amplifying circuits are designated for both radio, intermediate, and audio frequencies. For use on IF and RF frequencies the amplifier circuits must be tuned, this being accomplished by means of a standard tuning condenser arrangement.

The circuit has three so-called basic channels, one known as the **RF-IF channel,** another the **oscillator channel,** and the third as the audio **frequency channel.** The **RF-IF channel** consists of a turnable amplifier capable of tuning over certain wave bands extending from 95 kilocycles up to as high as 1700 kilocycles. The output of these amplifiers feed into a diode rectifier and the rectifier output controls the electron ray tuning indicator. In using the RF-IF channel, the input of the amplifier is connected by means of probes to the portion of the radio circuit to be checked. The amplifier is then tuned for the known approximate frequency of the signal at the point that is being checked. If the signal is present, it is so indicated and the fact is shown by the deflection on electron tuning indicators associated with the RF-IF channel. Because of the high gain available, measurements can be made in almost any portion of the RF circuit even directly at the antenna terminals.

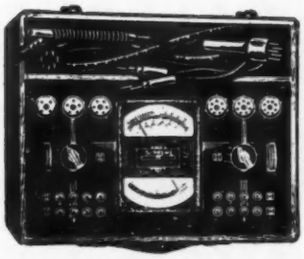

Fig. 98.—Modern Radio Set Analyzer

A similar arrangement known as the **oscillator channel** is provided. This channel employs a tuning amplified capable of checking oscillator operation as high as 70 megacycles. The same procedure is followed using this channel as the other, namely the amplifier circuit is tuned to the frequency of the oscillator, and the presence of the oscillator voltage is indicated on a tuning eye.

The AF channel is of course untuned and consists of an amplifier, diode rectifier, and the electron tuning indicator. This channel is substantially flat in frequency response from 50 to 50,000 cycles. The magnitude of the audio signal can be checked by connecting probes to various points in

...because he used Amertel

This typical American expression of finality describes exactly how telephone men feel when they string Amertel wire. They know that sound engineering and lasting construction calls for the very qualities offered by Amertel galvanized iron or steel wire.

This is true regardless of weather and local conditions for there's an Amertel wire for the longest span or the shortest span . . . for the heavy loading zone and the light loading zone.

And, right now this extra strength and quality that's in every inch of every type of Amertel is more important than ever. It helps do away with repairs, replacements and service calls. The job is done—"once and for all"—when you use Amertel.

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LOOKS THE SAME THIS YEAR

We wish our Christmas message could suggest friendly calls across the miles. But war's demands on the telephone are still urgent. That is why we must again ask the public to co-operate in helping war calls get through during the Christmas Season.

The advertisement on the opposite page appears in national magazines during December.

An Advertisement of the Bell Telephone System

WAR *STILL* NEEDS THE WIRES THIS CHRISTMAS

Please help keep LONG DISTANCE circuits clear
for necessary calls on December 24, 25 and 26.

BELL TELEPHONE SYSTEM

the audio circuit. A jack is available for listening to the signal on headphone if desired.

Electronic Voltmeter Circuit

N addition to the three basic channels which permit checking RF, IF or AF of the receiver, a fourth circuit is available which is referred to as the **electronic voltmeter circuit.** It employs a vacuum tube and a direct reading meter type voltmeter. This meter has an exceptionally high input impedance. On some of the scales the impedance is as high as 2,000,000 ohms and permits checking both D.C. and A.C. voltages without disturbing a high resistance circuit. An ordinary power supply is available to furnish D.C. power for operating the several amplifiers. The probe leads which are furnished consist of shielded cables having exceptionally low mutual capacity.

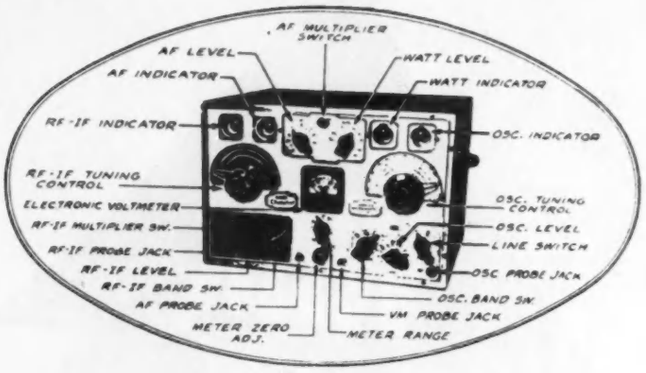

Figure 100.—Chanalyst Control Panel

Use of the Chanalyst

TYPICAL of the uses of the chanalyst is in the checking of oscillators. Figure 101 illustrates how the instrument would be used for this purpose. The check is made by placing the oscillator probe in contact with the oscillator control grid or plate or at any point on the high side of the tuned circuit as shown. The oscillator indicator that is the tuning eye will show the presence or absence of the signal.

RF and IF circuits are checked by simply connecting the RF-IF probe to various points along the circuit starting at the antenna and working back toward the audio end of the receiver. The tuned RF-IF amplifier must of course be turned to the approximate frequency of the incoming RF signal, and when the IF stages are checked to the IF frequency. The various voltages on the plate, screen, oscillator grids, etc. can be checked precisely by the use of the electronic voltmeter circuit which is direct reading and which has an extremely high impedance, hence does not affect the circuits themselves.

It seems apparent to the editor that the chanalyst will take its place as a very worthwhile instrument particularly in the larger shops where it would enable a service man to speed up repair work due to the rapidity with which one should be able to get at the source of trouble.

Instrument Protection

AS have been pointed out, ammeters can readily be burned out by inadvertently connecting them in parallel rather than in series with a circuit. They can also be burned out by a current overload.

THE SECRET IS OUT!

Our ACE-IN-THE-HOLE is SERVICE!

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Answer—

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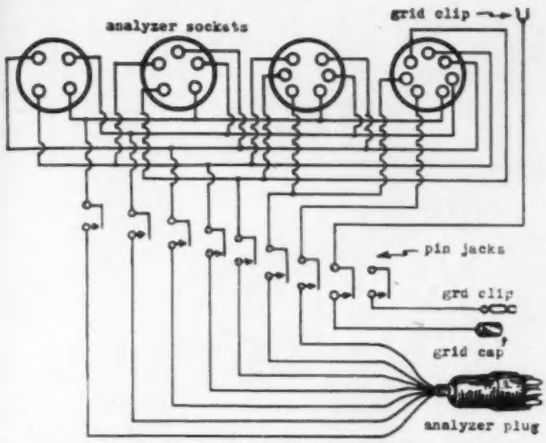

Figure 97.—Schematic of Radio Set Analyzer Circuit.

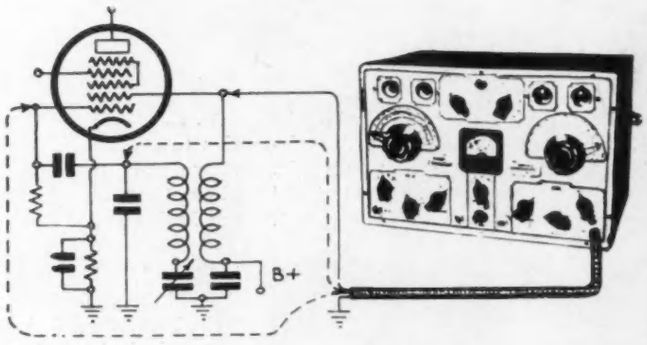

Figure 101.—Typical Application of Chanalyst.

When meters are apt to be carelessly handled, as for example in schools or where used in experimental circuits in laboratories, the instrument should be protected against damage by the use of instrument fuses. These fuses are merely extremely low capacity fusible links that will blow promptly on current overloads. These fuses are available in sizes as low as 1.0 milliampere, other sizes in common use are 1/64, 1/32, 1/16, 1/8, 1/4, and 1/2 ampere. Fig. 102 shows an instrument fuse and fuse holder.

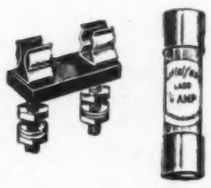

Fig. 102.—Instrument Protective Fuse and Holder

(Examination questions covering Sections I, II and III are on page 71. The answers to this series should be sent in as soon as possible. Section III is the concluding part of the series on Alternating Current Instruments.)

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WIRE LIFT
CHANCE PIKE POLES have the extra features...
When you buy a Chance Pike Pole, you get a pole with a reversible point that can be inserted into the ferrule point first when not in use leaving no sharp projection. Worn points can be replaced. A wire lift attachment may be inserted in the same ferrule. Chance Pike Poles are lacquer finished and are reenforced at the butt by a metal ferrule which prevents splintering.
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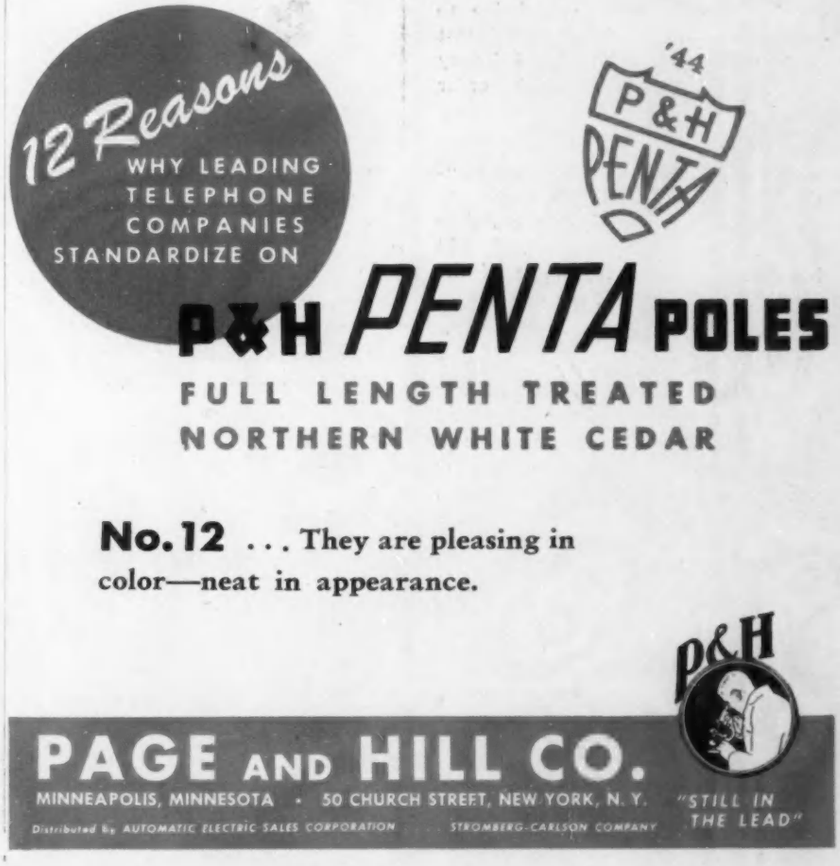
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Personalities IN THE NEWS

Chas. W. Boutin, Southeast Missouri Telephone Company, Cape Girardeau, outlined some of his plans for new buildings and equipment for his company to the Editor while attending the Missouri convention last month. There were a number of employes of that company also attending sessions. Their post war plans are almost completed.

•

James Herring, owner of the Atwater (Minn.) exchange has been authorized by the state commission to purchase certain rural lines adjacent to Atwater from the Kandiyohi County Public Service Company. The order was issued December 5.

•

Carl and Lillian Rosenvold were authorized December 5 by the Minnesota commissioner to purchase the Askov (Minn.) Telephone Company. It will be operated under the name of the North Pine Telephone Company.

•

We regret to report two recent deaths, that of Mr. William Henry Cox, superintendent of the Brodhead (Wisconsin) Telephone Company, and that of James W. Johnston, treasurer and director of Western Electric until his retirement in 1926.

Wm. S. Gard, formerly with the Ohio Independent Telephone Association, has been promoted to Captain. **Captain Gard** is now with the 3rd Army on the European fighting front.

E. A. Reinke and **Harry B. MacMeal** posed for your Editor during the recent Missouri convention. Combined their service record equals 97 years service to Independent telephony. **Harry** is with the Runzel Cord & Wire Company with a 51 year record and **Gene Reinke** of Stromberg-Carlson has served the industry 46 years.

•

A. C. Neff, for 45 consecutive years manager of the Champaign (Ohio) Telephone Company, has retired. **M. B. Wetzell** succeeds him.

T. R. Means has received authorization to sell the Belmore (Ohio) Telephone plant to the Community Telephone Company of Leipsic. The joint application has been granted.

•

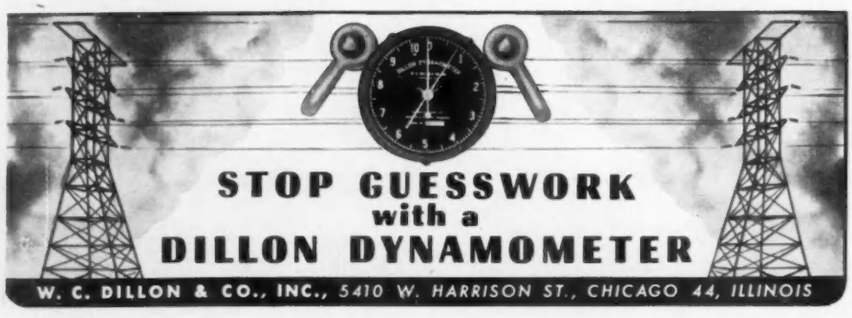
Clyde S. Bailey, executive vice president of the United States Independent Telephone Association, Washington, was principal speaker at the recent Virginia convention. He was selected by members of the association to present to **Kelley McNish,** the retiring president of the association, a handsome silver sandwich platter. The sentiments of his friends were beautifully expressed by **Mr. Bailey** during the banquet and graciously acknowledged by **Mr. McNish.**

•

Frank V. Newman, 74, former Muskegon commercial manager of the Michigan Associated Telephone company, died November 15 in Davenport, Iowa. **Mr. Newman** had a service record of 55 years in the telephone business and retired in 1941 because of ill health.

•

W. H. Beck, secretary of the Indiana Telephone Association, has been busy during the past two months with district meetings held in all sections of the state. The plan was a huge success. Each meeting was started with a complimentary dinner by the Association anl then a 3-part program was followed. **N. N. Bott,** Rensselaer, was made president in District 3, **C. O. Morgan,** Argos, was named president of District 1, **D. N. Van Fleit,** Garrett, was named president of District 2 and **E. A. Ransdell,** Connersville, was named as chieftan of the District 4 group. Three meetings were held during December at Greencastle, North Vernon and Jasper.



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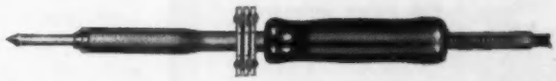

DRAKE No. 400, for example, is ideal for work in small places—weighs only 8 ounces and is only 9 inches long, yet it is a 60-watt iron.

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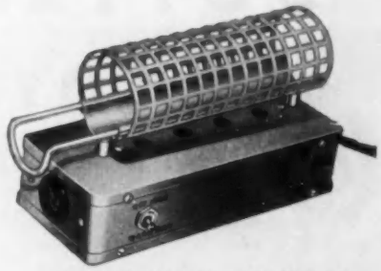

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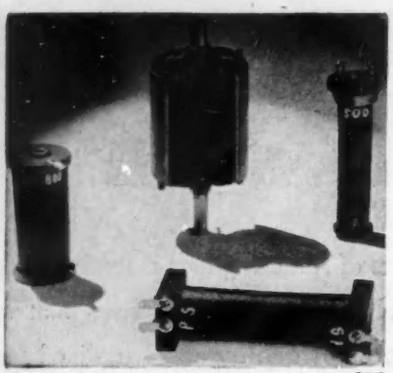

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Help is short—
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DEPEND ON SUTTLE

Rate Making Procedure For Independent Companies

(Continued from page 28)

on the part of the Treasury Department in its allowance for depreciation for income tax purposes as compared to that which may be allowed for rate purposes by regulatory bodies. It is possible to have a lower depreciable base as well as a lower depreciation rate for income tax purposes. This point should not be overlooked in calculating income taxes for rate adjustment purposes.

It has been observed that many small companies claim interest as an item of expense in the preparation of their income statement for rate adjustment purposes. Interest and debt expense are a part of the return on the investment and should not be used as an item of expense. Interest and debt expense are sometimes used as evidence as to the cost of money, thereby having an influence in determining the rate of return needed to attract capital.

A COMPANY having an operation involving several exchanges along with a well developed toll line system should separate the toll line investment as well as toll operating revenues and expenses from the exchange operation. In preparing a rate study for an exchange under such operating conditions, proper credit should be allowed for the toll operating commissions on the same basis as though no toll lines were owned. The operating revenues and expenses should also give effect to the use of toll property for exchange purposes, as well as for the use of exchange property for toll purposes. This applies primarily to the use of outside plant used in common, and not to a general toll separation study on a station-to-station basis. The present level of toll compensation is alleged to compensate the exchange for such usage from the toll board to the subscribers' station. An exchange having a toll center operation should take recognition of any added revenues where toll services are performed for the toll line system or other exchanges, such as toll switching operations that may have no relationship to the local exchange service.

At the time action is taken in respect to filing with a regulatory body, for an increase in rates, it is necessary to give thirty (30) days' notice to the Office of Price Administration, Washington, D. C., filing such information at the time as may be prescribed by their regulations. The Anti-Inflation Law was enacted in October, 1942, and among other things provides:

"That no common carrier or other public utility shall make any general increase in its rates or charges which were in effect on September 15, 1942, unless it first gives thirty days' notice to the President, or such agency as he may designate, and consents to the timely intervention by such agency before the Federal, State or Municipal authority having jurisdiction to consider such increase."

Based on experience, a telephone company may well expect active participation on the part of the Communications Division of the O. P. A. in

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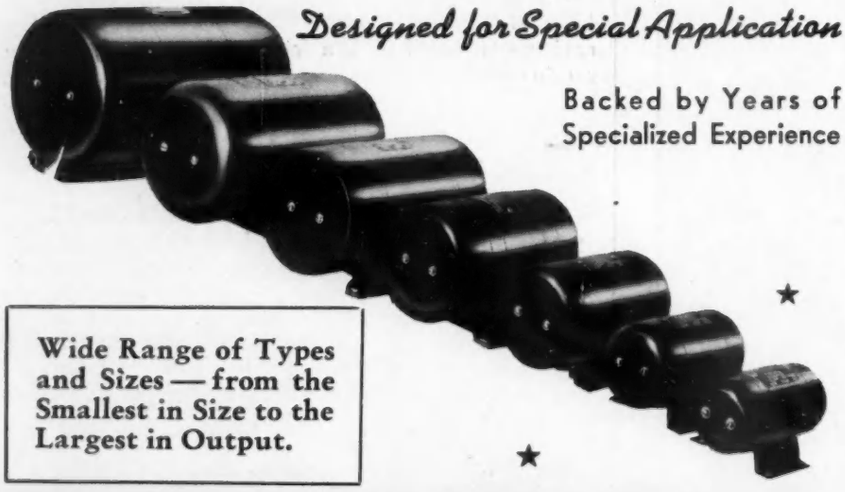

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any rate proceeding involving an increase, with perhaps a few exceptions. Where a conversion of one type of service to another takes place, and when the consent of the subscribers or the body having jurisdiction over rates is obtained, there is less likelihood of O. P. A. intervention. This statement is made with reservations as it has been observed only in such cases involving very small exchanges where the amount of the increase is small and not likely to disturb other price levels.

When considering the continued upward trend of wages and other operating expenses affecting operating results, the writer wishes to emphasize the importance of keeping comprehensive and adequate records so as to be in a better position to adequately prove the need of additional revenues as and when it becomes necessary. Under present conditions, it is advisable to employ proper legal talent, an engineer and an accountant to prepare the case. The smaller the property, the smaller the cost of such preparation. Many operators attempt to handle a case on a one man basis, which in many cases leads to disappointment due to lack of skill and experience and failure to present their facts in the form of accredited evidence.

Acquire New Cedar Lands

The Mac Gillis & Gibbs Company, Milwaukee, Wisconsin, have purchased 5,000 acres of valuable cedar lands, the Ensign concentrating yard and logging equipment from Skaug Brothers of Escanaba, Michigan. This purchase gives Mac Gillis & Gibbs access to more cedar poles and three active concentrating yards in Upper Michigan. Shipping points are now Ensign and Wallace. They have also opened White Cedar Pole buying agencies at Grand Rapids, Deer River, Great Falls and Little Fork, Minn.

Col. Stannard Retires

Col. E. M. Stannard, former president of Wolverine (Michigan) Chapter of Telephone Pioneers of America and general traffic manager for the Michigan Bell Telephone Co., is retiring after over 42 years of service with the Bell System. He has a distinguished record as a soldier and civic leader and served in World War I as director of telephone and telegraph service for the AEF. Roy E. Bradstrum, dial traffic engineer, who has been with the company 23 years, succeeds him.

Death of Francis Hubbard

Francis A. Hubbard of Maplewood, N. J., Bell Telephone Laboratories development engineer, who during his 29 years in the telephone industry had planned and supervised important long distance telephone construction in Europe and in South America during the '20s, died last month at his office in the Laboratories from a sudden heart attack. He was 54 years old.

Mr. Hubbard served with the International Standard Electric Co., foreign manufacturing affiliate of the International Telephone & Telegraph Corporation, from 1925 to 1930 and during that period as its transmission engineer and later as its assistant engineer, he planned and supervised the laying of the Stockholm-Gothenburg long distance cable and a similar toll cable connecting Milan, Genoa and Turin. In 1928, he established the first telephone circuit across the Andes Mountains in South America. He also had served as the vice president and general manager of the Mexican Telephone & Telegraph Co., I. T. & T. affiliate, from 1929-30.

•

About 4¼ million out-of-town telephone conversations are held daily in the United States.

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THIS COMPANY will purchase or arrange for the private purchase of securities of or make private loans to Independent telephone companies on reasonable terms, or will arrange credits for such companies, either small or large, when needed for the purpose of postwar rehabilitation of plant or conversion of equipment or for additions or improvements.

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Telephone Engineer

HANDBOOK TABLES

Index—Outside Plant Design
Date—December 15, 1944

Wire Clearances

For the safety of the public and employees of public utilities minimum clearances are prescribed for situations involving wire crossings over roads and railroads and wire crossings of, or joint construction by two or more different utilities. These minimum clearances are based on the National Electrical Safety Code—Part 2 (National Bureau of Standards Handbook H-32). Where these requirements conflict with those specified by state or municipal regulations, the latter regulations govern.

Since these authorities specify that minimum clearances in all cases shall be obtained under arbitrary conditions of temperature (60 degrees F, no wind) and sag of wires and cable after storm loading has been applied, it is impracticable to attempt to determine the exact clearances that should be obtained at the time of the installation of the telephone plant. Instead wire or cable should be placed to obtain greater than the minimum required clearance in all cases where practicable.

Minimum clearances are specified for the following situations:

(1) Poles and stubs adjacent to other objects.

(2) Telephone lines crossing above travelled ways and paralleling rights-of-way.

(3) Telephone lines crossing other lines.

(4) Telephone lines carried with other lines on the same poles (joint use construction)

(5) Vertical and lateral runs.

(6) Climbing space.

Minimum Side Clearances

The minimum horizontal clearance of poles and stubs and their guys and braces from other objects, measured between the nearest parts of the objects concerned shall be as shown in Table No. 1.

Table No. 1
Minimum Horizontal Clearances of Poles and Stubs from Other Objects

Nearest Part of Pole or Stub	Amount of Clearance
From fire hydrants.	4′
From street side of curb.	12″
Railroad tracks (from nearest pole or guy of crossing or paralleling overhead line measured to nearest rail of main track. (Note 1)	12′
Railroad tracks, from nearest pole or guy of crossing or paralleling overhead line measured to nearest rail of siding, provided sufficient space is left for driveways at loading and unloading points.) (Note 1)	
Poles or other supporting structure of another line from telephone conductors or telephone poles and stubs from conductors of another line. (Note 2)	3′

Note 1—When it is necessary to provide a clear view of railway signals and signs, the poles shall be set back sufficiently to provide the necessary clearance.

Note 2—If practicable—for each 2 feet of the distance that separates the supply and telephone poles, increase the clearance by one inch. The climbing space on the telephone pole shall not be reduced by a conductor of the other line.

Highlights of the Communication News

(Continued from page 38)

an interest rate of only 1¾ percent with 35 years to repay the principal amount.

The plan to make available 20 percent of the loans to small telephone companies, Senator Hill pointed out, "would have every opportunity to obis called the Independent companies, would have every opportunity to obtain funds to build new lines and modernize their exchanges at an extremely low rate of interest and on long term repayments."

For the spectre of state owned telephone systems, the measure proposes that the remaining 50 percent of the $100,000,000 appreciation would be available for loans to any state or territory with not more than 10 per cent allotted to any one state.

The Rural Telephone Administration would have an administrator to be paid $10,000 a year and would have an administrative operating appropriation for its functioning from the federal treasury.

The idea of a RTA was first advanced by FCC Commissioner Clifford J. Durr in an address last September. In mid-November the FCC Economics Division issued a report showing the decline in farm telephones from 1920 to 1940.

In an address at Stephens College, Mo., Nov. 18 in which he reviewed in a most interesting way the vistas ahead in all fields of radio—FM, television, facsimile, aviation and radio telephony—, FCC Commissioner Paul A. Walker touched on the farm telephone situation. Commissioner Walker stressed that because the farmers have done so much on the production front for the war effort after the war they "are entitled to economical telephone service." Recognizing that the United States has the finest telephone service in the world, Commissioner Walker did suggest that "if industrial interprise with all its resources cannot or will not provide telephone facilities at reasonable costs, then the millions of farmers in America may well resort to their own collective efforts to secure them as they have secured electricity through the Rural Electrification Administration."

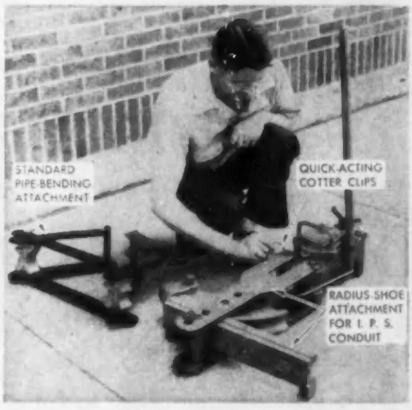
Lead Shortage WPB Meeting

THE suddenly serious shortage of lead which may interfere with the telephone industry's 1945 toll and

Speed Pipe Bending THIS EASY GREENLEE WAY!

1 One stroke of quick-positioning lever brings shoe snug against pipe, ready for application of pressure. This short-cut eliminates time and labor of hand-pumping shoe into position. Then lever handle is transferred to operating lever.

2 By pumping operating lever handle, hydraulic pressure is exerted on pipe. Bend is complete when contour of shoe is almost filled. Graduations on ram permit operator to identify precise length of travel of ram, for making exact, duplicate bends.



3 Operating lever is forced down to its lowest position, releasing pressure. Handle is then transferred to the quick-positioning lever for withdrawal of ram. Pipe can be withdrawn entirely or moved for second bend. Then the process in steps 1, 2 and 3 is repeated.

4 Quick-acting cotter clips (an exclusive GREENLEE development) make change to another type of pipe-bending attachment a fast, easy job. With attachments, one bender can handle pipe, rigid and thin-wall conduit, bus bars and larger sizes of tubing.

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exchange cable construction programs to a substantial degree was the most important topic of discussion at the Telephone Operations Industry Advisory Committee meeting of the WPB Communications Division in early December.

The supply of lead has never been seriously critical until at present but occurred due to sharply increased ammunition requirements. As a result, the WPB is expected to be placed soon on a 100% allocation basis, and it has been proposed to make a 20% blanket cut of lead supplies to manufacturers instead of priority ratings on projects. In the event of a blanket cut, telephone companies can record appeals for emergency authorization of the metal.

Most of the session dealt with the industry committee's views on the division's appeals machinery and the members of the committee expressed compliments and satisfaction over the way the appeals were being handled and felt there was no reason to revise the present procedure. Committee Presiding Officer Eugene Merrill, Division Telephone Section Chief, explained the entire appeals machinery and cited typical cases of denial or grant of preference for telephone installations. The appeals to the division have been greatly decreased from 3,200 a week last June to 700 weekly now.

A simplified form for reports on station movements was approved and the committee agreed to the idea of eliminating a good deal of the supporting data in Form 2774 to be supplied by certification of the facts.

Frequency Allocations

BECAUSE of the problem of adjusting conflicts and requirements between permanent and temporary goverment frequency assignments and non-governmental radio services, it may result that the FCC cannot approve a postwar spectrum allocation plan until after the first year. There was some possibility of a partial determination of frequency assignments by the Commission towards the latter part of December, but that will be dependent upon the results of the conferences between the FCC representatives and the Interdependent Radio Advisory Committee which handles government frequency needs. These conferences between the FCC and IRAC commenced Dec. 7.

With the change of the outlook for a longer war in Europe, as contrasted with last August and September, the pressure for a final FCC determination of the postwar spectrum for civilian use and for the preparation of the United States' position in the projected world radio conference has been relaxed so that the Commission has not been forced to transmit its findings to the State Department as had been previously scheduled during early December. In fact, on the planned date of December 1, when the State Department had indicated it desired to receive recommendations on frequency allocations, the FCC advised that Department it is now engaged in the study of preliminary proposals, prepared by its staff on frequency allocations for non-governmental radio services. The FCC on that date tentatively approved an allocation plan in international (services) terminology relating to frequencies below 30,000 kilocycles but deemed it advisable to defer final action until the plan had been discussed with the IRAC. However, the FCC stated that "it is anticipated such a plan may be made available at an early date."

On the frequencies above 30,000 kc which are most important to the telephone industry because of its program for short-haul toll and rural radio telephony in that region of the spectrum, the FCC engaged in most intensive study of the allocation plan prepared by its staff.

Indicating that the FCC allocations

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will not be available until January, the State Department's industry-government committee which is preparing the American position in allocations for the prospective world Telecommunications Conference and the Inter-American Radio Conference to be held in Rio de Janiero next June postponed its next meeting from mid-December until after the first of the year.

Wire & Batteries Critical

THIRTY-SIX percent of the entire communication-electronics military production program is critical in terms of shortages of deliveries in relation to actual combat operations.

Tactical field telephone wire, both assault and field wire, together with long range communication wire, has had its requirements increase much more rapidly than it has been possible to expand facilities. Because of huge requisitions from combat theaters far out of line with production possibilities, the critical types of wire are now on a ration basis to each theater commander. Standing facilities of assault wire have been the major limiting factor, and the Signal Corps is desirous of all stranders being operated around the clock. Long range communications wire requirements have quadrupled since the first of the year and a former Ordnance plant at Lowell, Mass., is being converted to manufacture this wire. The lack of rubber has made insulation a problem. The main job now is to insure that facilities operate at capacity and to correct some minor labor shortages. For the first quarter of 1945, field wire requirements are estimated at 200,000 miles a month. The progress in the tactical field wire production in licking its critical program is 41% production above June, 1944, output.

Dry cell batteries, another highly critical Signal Corps equipment item, has been increasing its production rapidly so that it is now more than 50 percent above the beginning of the year. By January, with the continuation of the present urgency rating on labor and continued pressure to maintain capacity operation, production ought to meet military operational needs. It is estimated that around 250,000,000 dry cell batteries will be required in the first quarter of 1945. Because the dry cell battery industry is a low wage field, some plants have been starved for labor, but incentive wage systems have been installed. About 1,500 additional workers will be needed as new facilities come in.

International Communications

THE formulation of international communications policies for the United States, particularly the merger of the American international communications companies, has been occupying the attention of the State Department and its special interdepartmental postwar planning committee on communications. The Senate Interstate Commerce Committee with its added fund of $10,000 will resume its study of the projected international merger in the new Congress but probably will not get down to concentrated functioning until the latter part of January.

Assistant Secretary of State Will Clayton, rated as one of the ablest officials in the Government because of his handling of the Surplus War Property Administration anl his private career as one of the leading businessmen in the cotton field in the nation, is to handle communications succeeding Assistant Secretary Berle. (At this writing Senate confirmation of Mr. Clayton's appointment had not been completed, but it was felt to be assured.) The exceptional ability of Mr. Clayton togehter with his integrity and knowledge of world anl economic matters, makes his designation as the one in charge of communications policies most beneficial to the industry.

Despite the fulminations of the left-wingers against the recent State Department appointments of Secretary of State Stettinius, Undersecretary Grew, etc., President Roosevelt appears to be desirous of getting the ablest persons in the key positions.

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U. S. Rubber Appointments

Ernest G. Brown, general manager of the mechanical goods division, United States Rubber Company, announced today the appointment of Herman A. Everlien as general sales manager of the division and Walter F. Spoerl as merchandise manager. Both men began their rubber careers at early ages as clerks in the sales department of the old Revere Rubber Company in Chicago, later consolidated into the United States Rubber organization.

Herman A. Everlien, newly appointed general sales manager of U. S. Rubber's mechanical goods division, has had more than 41 years' experience in the industry.

$257,000 Toll Project

The A. T. & T. and Southern Bell have been granted authority by the FCC to supplement existing toll facilities with carrier between Selma and Goldsboro, N. C. at an estimated cost of $257,000.

Turner Purchases Exchange

The Missouri Public Service Commission has approved the application of Frank M. Holland to sell and E. O. Turner and Alice Turner to purchase the telephone exchange at Auxvasse, Callaway Co., Missouri.

Burlington To Install Much New Equipment

LINCOLN, NEBR.-The Burlington Railroad will install additional telephone and teletype facilities costing approximately $690,000 to meet present demands and in anticipation of an increase of military traffic to the west coast, is was announced by Edward Flynn, executive vice president.

The work, to begin immediately under the direction of H. H. Masselbacher, telegraph superintendent, will include 1,500 miles of wire and new carrier apparatus.

Flynn said the project will provide new or additional telephone and teletype service between all principle terminals and division points, important intermediate stations, yards, storehouses and shops.

Approved by the war production board, the work is expected to be completed in 1945.

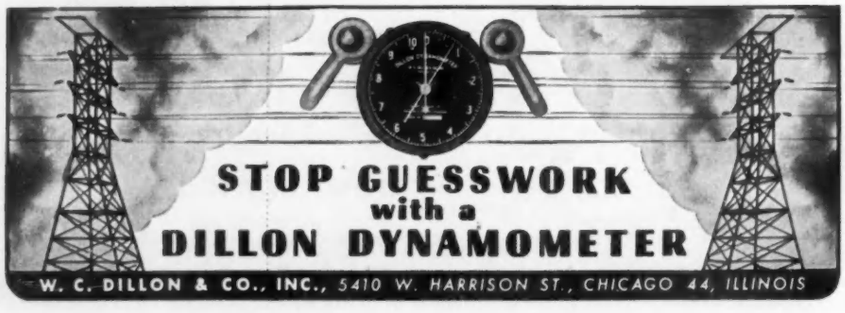
Signal Corps Aided By Reverse Lend-Lease

Of the needs of the U. S. Army Signal Corps in the European Theater, 22 per cent was supplied by the United Kingdom through reverse lend-lease from June 1942 to June 1944, President Roosevelt stated in his report last week to Congress. Britain also contributed greatly in money and manpower to the telephone, telegraph, radio and other communications services required for one to two million U. S. fighting men.

In the Pacific Theater of Operations, Australia produces such equipment as transmitters and receivers, wire and cable, tubes and batteries and meteorological balloons. Australia and New Zealand also pay the cost of telephone, telegraphic, and cable services under reverse lend-lease.

On the basis of comparable figures, the number of Bell System telephones has more than doubled in the last 20 years, while the volume of long distance messages has increased sevenfold.

In Washington a special War Department staff answers long distance telephone calls from grief-stricken wives and parents.



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Alternating Current Instruments

1—Explain the theory of the Dynamometer and A.C. wattmeter.

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3—Explain briefly the general features and theory of the Sangamo mercury type A.C. kilowatt hour meter.

4—Of what use are cathode ray oscillographs?

5—What does the synchronizing circuit accomplish and how does it work?

6—Is the input impedance of a cathode ray oscillograph low or high?

7—Explain the operation of the Bell type impedance bridge.

8—Can effective resistance be measured with the RCA Universal type bridge?

9—Describe the essential parts and basic method of use of the radio set analyzer.

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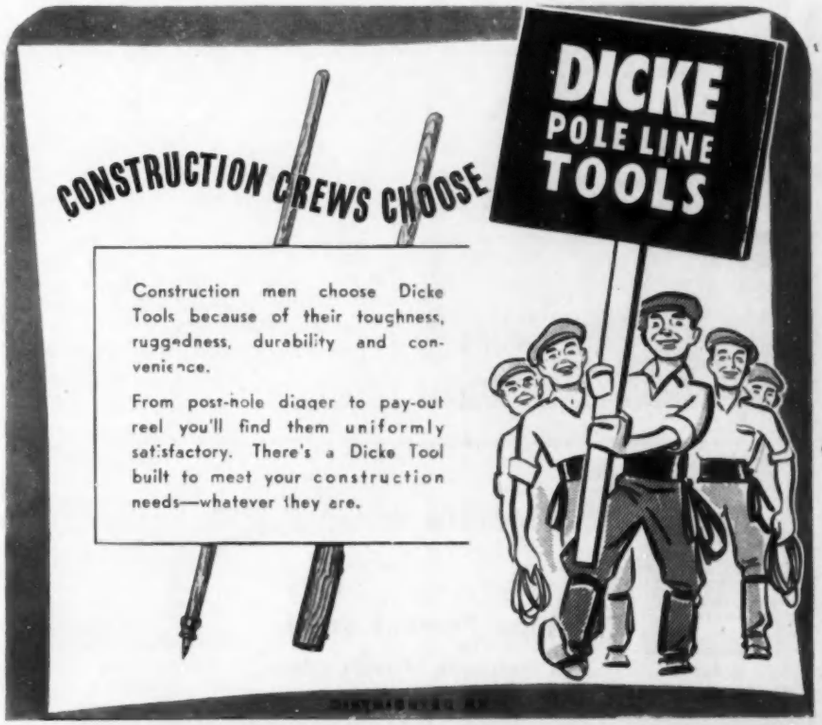
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Pearce Buys DeWitt Properties In Iowa

C. C. Pearce, manager of the Farmers' Telephone Company, Riceville, Iowa has purchased the Lime Spring (Iowa) Telephone Exchange from Edith F. DeWitt, widow of the late Major DeWitt, who died recently. The property adjoins the Riceville property on the Northeast.

The Riceville exchange will remain under the management of Mr. Pearce who owns a considerable interest in that company. He purchased the Lime Springs property outright and will manage both exchanges.

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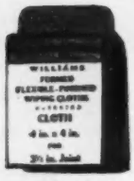

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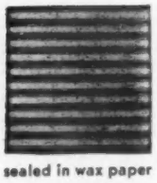

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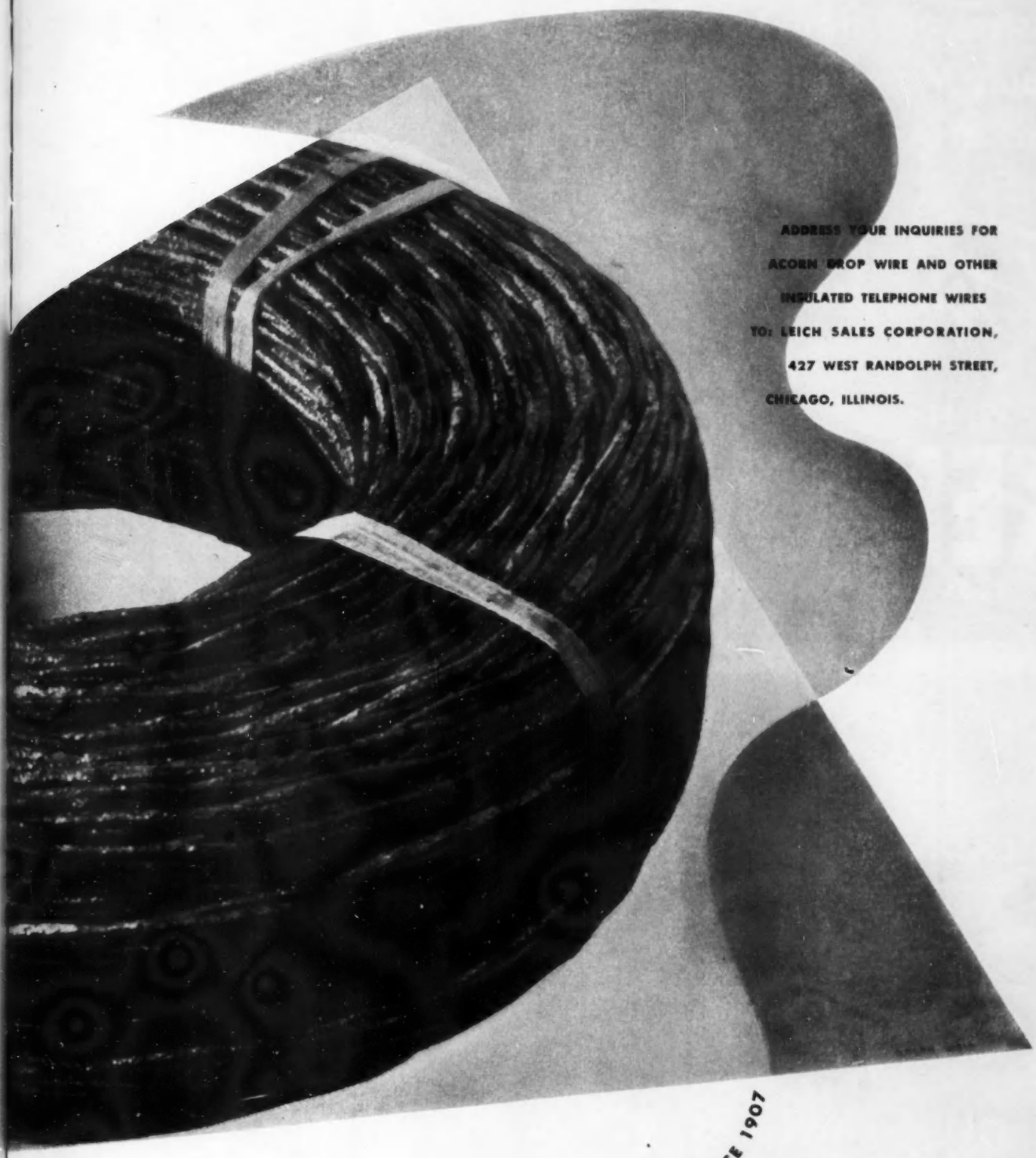

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ACORN DROP WIRE AND OTHER
INSULATED TELEPHONE WIRES
TO: LEICH SALES CORPORATION,
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ANUFACTURERS OF TELEPHONES, SWITCHBOARDS AND RELATED APPARATUS SINCE 1907

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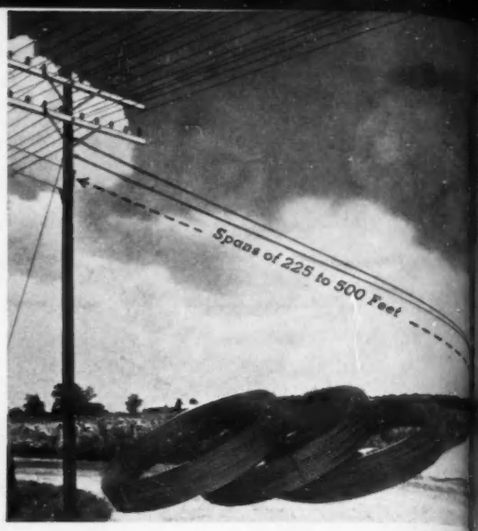
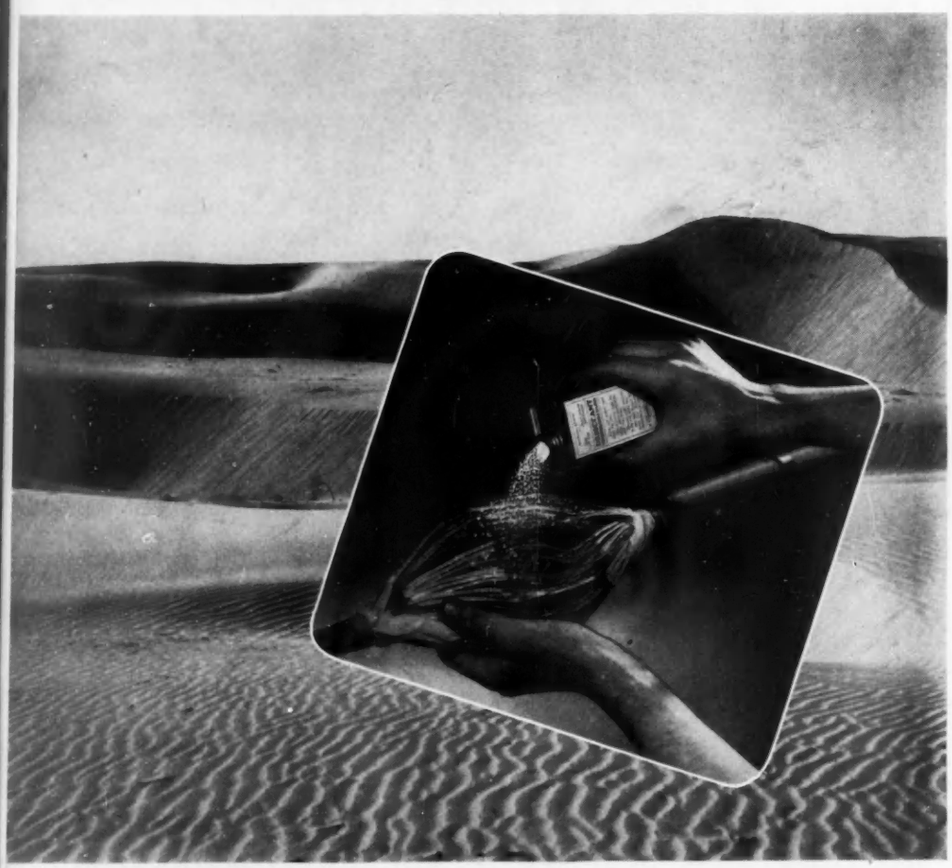


Look Ahead to the time you'll resume construction. Decide now to make INDIANA STEEL & WIRE COMPANY'S Crapo HTL-85 and HTL-135 Line Wire your standard. Save on construction costs, reduce maintenance and improve transmission.

A "Must" for Every Company. Pulley Blocks by A. B. CHANCE CO. are still available without excessive delay. These light-weight rope blocks with ratchet levers come in four sizes, capacity range to 5,000 pounds, and leverage ratio of 32 to 1.



Drier Than a Desert at Its Driest! Drierite Desiccant is the better, safer way of drying out splices in lead covered cables. All you do, after wires are spliced, is to bind a cotton gauze under the splice and sprinkle Drierite granules in among the conductors. This W. A. HAMMOND DRIERITE CO. product absorbs all moisture, making the splice about the driest part of the cable line. The desiccant will not injure or corrode the sheath, conductors or insulation.

Honorably Discharged. Although the major part of KELLOGG SIGNAL BRONZE drop wire is still "in the army," limited amounts are being released for domestic use. Its insulation, strength, conductivity, and longevity make it today's ideal drop wire.

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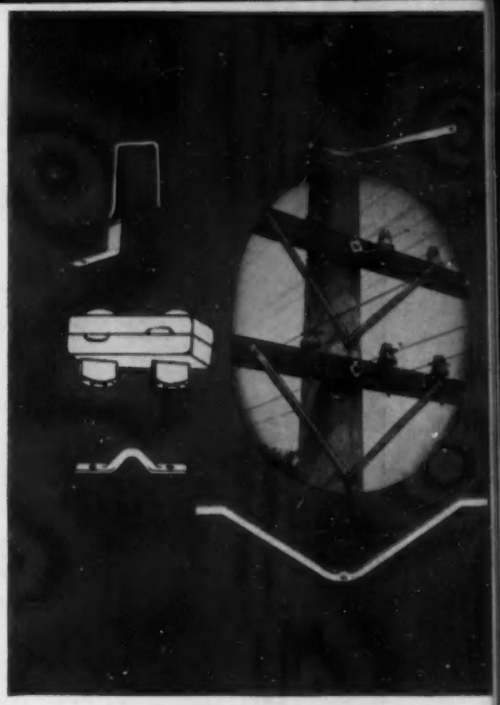
Not a Kink in a Carload. Subscribers prefer *Kellogg* Koiled Kords because they stay out of the way. For these cords smoothly stretch out to 6 or 7 times their normal 9-inch contracted length . . . yet retract instantly in a short, neat spiral. This greatly lessens the chance of the cord tangling with other objects or catching under desk or table corners to damage the telephone. *Kellogg* Koiled Kords are permanently molded in their spiral shape . . . fit various makes of phones.



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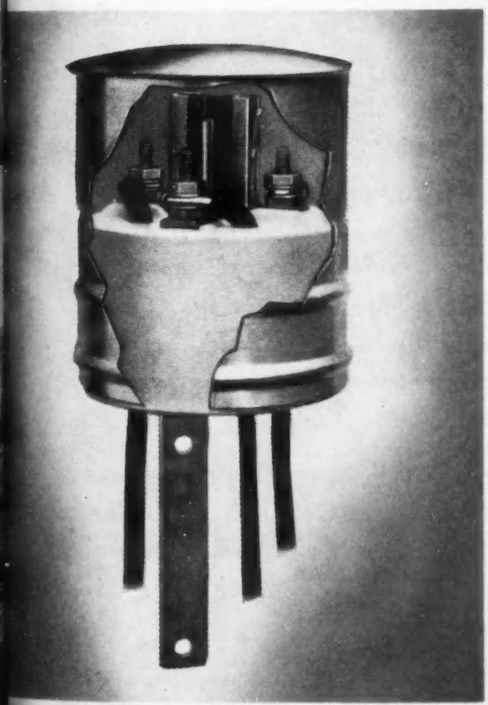
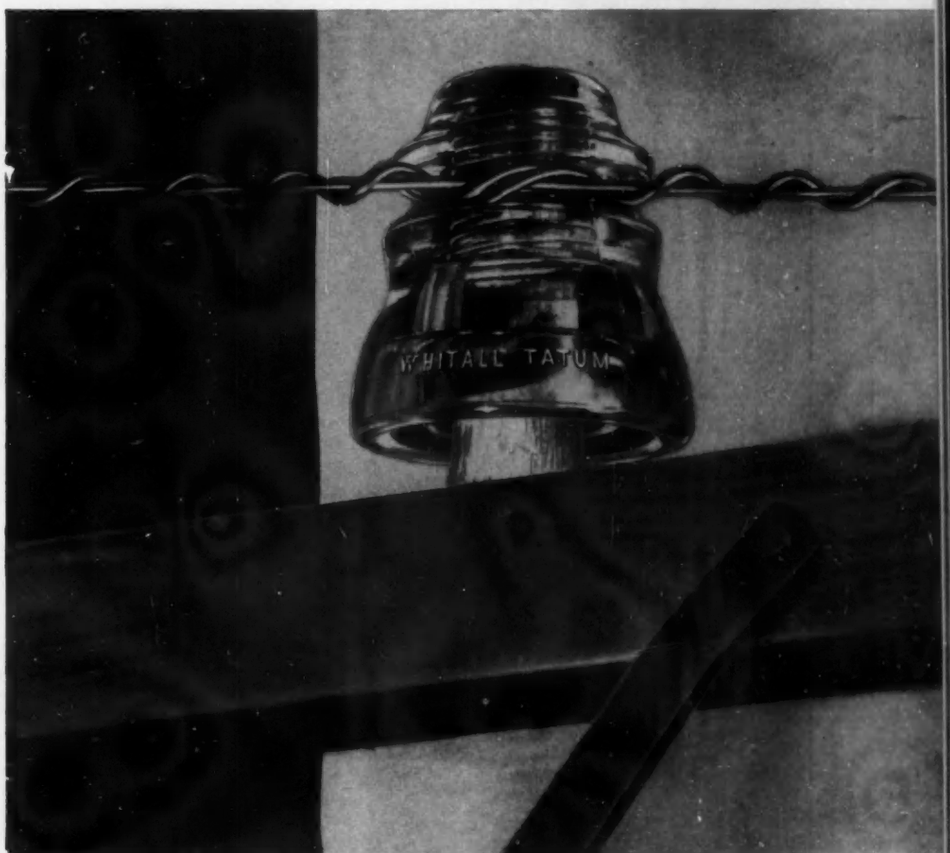


Safety Island. The No. 402-RR Dry Spot Lightning Arrester fills the need for an arrester that can be used freely on long communication lines without appreciably lowering insulation resistance. Another RELIABLE ELECTRIC CO. product.



Meet Every Service Need. There's a size and style of Armstrong Whitall Tatum insulator for every requirement—one reason why many telephone companies use this ARMSTRONG CORK CO. product. In addition, they feature crystal clarity of glass, which discourages vandalism; accurate gaging to assure true pin fit; and unusual resistance to temperature changes. To reduce insulator maintenance on your lines, Armstrong Whitall Tatum Insulators are a good bet.

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LOOK FOR LENZ THIS MARK OF QUALITY

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Rounds out 40 years of building quality Cords, Wires and Cables and a realization of our ambition to make the best product possible.

Answering the call to fulfill today's severest problems paves the way to serve you with better products tomorrow.

Sturdy tinsel conductors having moisture-proof insulation finished with extra strong outer braid produces a Receiver Cord of longer life combined with trouble-free service. Write today for your copy of the LENZ Cord Chart listing all types of Cords for your convenience.

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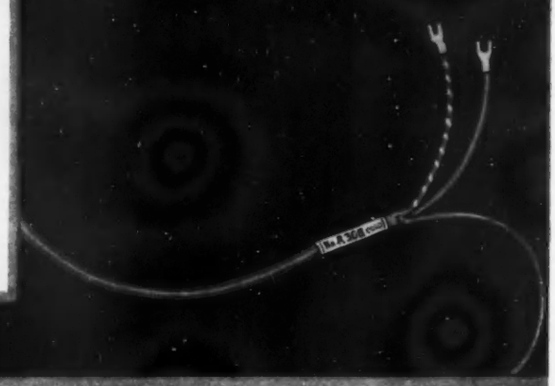

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1751 N. WESTERN AVE., CHICAGO 47, ILL., U. S. A.
"IN BUSINESS SINCE 1904"

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THE SCENE IS "SOMEWHERE IN ENGLAND." But the men are Americans—members of the U. S. Army Signal Corps. And the pole is American—grown and pressure-creosoted in the United States. Only the United States can supply poles of the finest quality, and in the enormous quantities required for military construction.

For many months, these military needs have had first call on Taylor-Colquitt production. But we look forward to the day when we shall again be able to make prompt shipments to meet YOUR requirements.

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"Copper-to-Copper Contact"

A vital point in a satisfactory ground is the connection between ground wire and ground rod. When a copper grounding wire is clamped to a Copperweld rod the connection is copper-to-copper. There are no dissimilar metals in contact under the ground to cause galvanic action or electrolytic corrosion. For ground connections that are permanently safe and dependable, specify Copperweld non-rusting ground rods—made by Copperweld Steel Company, Glassport, Pa.

Copperweld NON-RUSTING **GROUND RODS AND CLAMPS**

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MONOTYPE DROP WIRE

Every time you have to take off a drop from the middle of a span, you'll be thankful for the built-in quality of Monotype Drop Wire. Its tight, firmly braided covering is slicked smooth—threads easily through the cable rings, for a quick job of installation. And once installed, it puts up a real battle against wear and weather. Years from now, your Monotype drops will still be giving you trouble-free service.

When you *must* buy drop wire, be sure you get Monotype quality. And please order well in advance of anticipated requirements.

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"Back so soon, soldier?"

A soldier put in a call for his mother, was told there would be a delay, and to come back later. Only a few minutes had passed when the operator looked up to see the same face. "Back so soon, soldier?" "Not me, sister, I just got in." She laughed, and said, "Then it must have been your twin brother." "By gosh, it was! Which way did he go?" Later he came back to thank her for a joyous reunion.

Just one more wartime story to add to the thousands that telephone workers, in every department, can tell. Every minute, of every day and night, operators, plant men and other telephone employees are facing unusual situations, giving a little *extra* service, beyond their regular line of duty. They carry on without any expectation of praise or reward. They are living up to the telephone tradition of faithfulness and dependability.

In Exide Batteries you will find the same dependability for which telephone service is famous throughout the world. Since 1895, Exides have been proving themselves worthy of that trust.

ARMY E NAVY

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TELEPHONE BATTERIES

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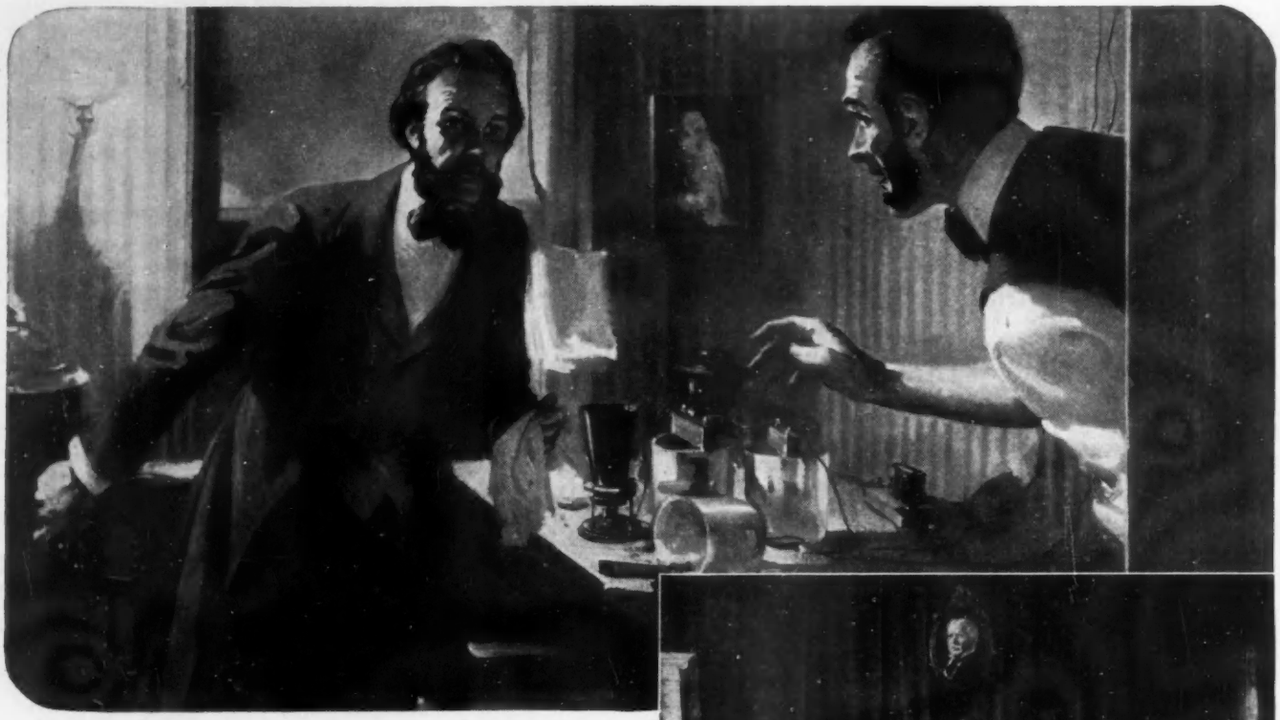

The Telephone Talks! "Mr. Watson, come here, I want you!" This sentence, spoken by Alexander Graham Bell in his Boston workshop on March 10, 1876, to summon his assistant, was the first ever transmitted by telephone. This great event led to the founding of the Bell Telephone System—for which Western Electric has been the manufacturer since 1882.

The Telephone Spans the Continent! On January 25, 1915, Mr. Bell in New York, once more talked to Mr. Watson, this time in San Francisco, on a momentous occasion—the opening of telephone service across America. This was made possible by Western Electric vacuum tube repeaters—first of many millions made for the Bell System.

EVEN BEFORE the first of these historic events, Western Electric—founded in 1869—was making electrical communications equipment.

The Company's work as maker of Bell Telephone apparatus since 1882 has led to many other sound-transmission products which enrich your life. Radio in all its forms—talking picture equipment—train dispatching equipment—public address systems—hearing aids—all owe much to the pioneering work of Western Electric.

This year—as the Company marks its 75th Anniversary—Western Electric is the nation's largest producer of electronic and communications equipment to speed victory.

During the 6th War Loan Drive, buy more Bonds than ever!

Radio Telephone Spans the Atlantic! Just before dawn on October 21, 1915, the first spoken words crossed the Atlantic—transmitted from Arlington, Va., and received in Paris by Western Electric radio telephone. Out of this pioneering came world-wide telephony—broadcasting—aviation, marine and police radio.

75TH ANNIVERSARY
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IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
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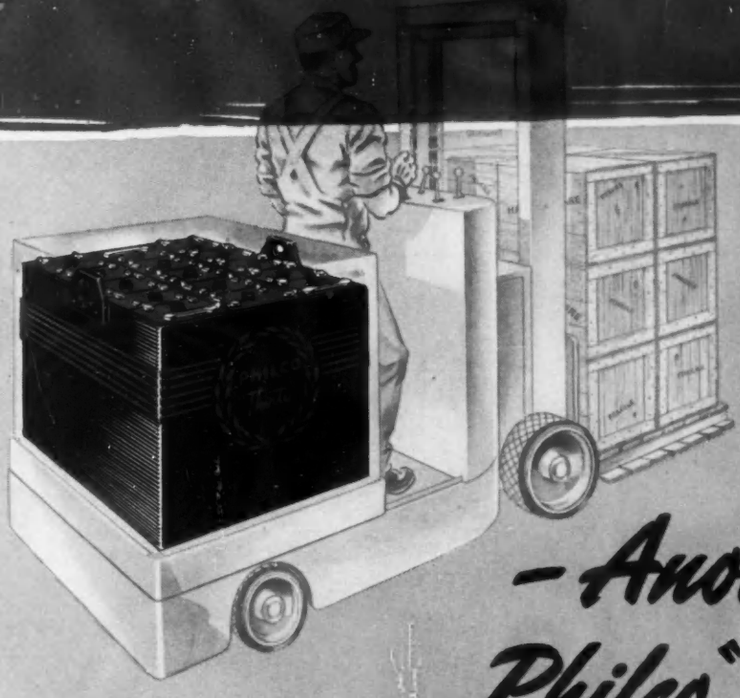
THE BATTERY THAT GIVES 30% LONGER LIFE



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Revolutionary new

PHILCO "THIRTY"

WITH 30% LONGER LIFE RADICALLY CUTS MOTIVE POWER BATTERY COST!

★ ***Reduces depreciation and maintenance***
★ ***Gets more work done***
★ ***Packs a terrific wallop***

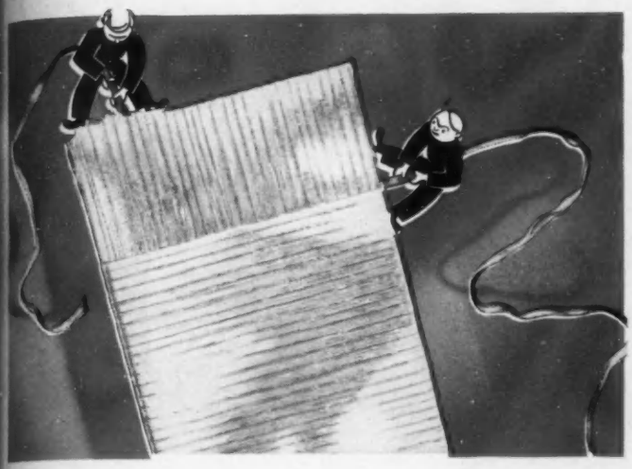
What every materials handling man wants in a storage battery is **packed** into this amazing new Philco "Thirty."

In high capacity, it is **tops** in the field—assuring the maximum tonnage every shift. Even after long hours of heavy work, it has the reserve power to climb ramps and grades, and complete the shift in *high.*

But the feature which sets the new Philco "Thirty" entirely apart from all other batteries you have known, used, or even heard of before—is its phenomenal long life. **30% longer life**—often more—has been demonstrated time after time in exhaustive field tests.

Here, then, is more than just a new and better battery. Here is a new standard of battery performance—*and* a new yardstick by which all battery values must now be judged.

That's why it will pay you to get posted on this great new Philco Battery which is now available in certain types and limited quantities. Full information gladly will be sent on request.

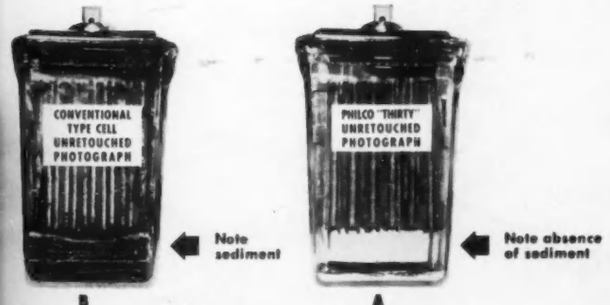


REVOLUTIONARY NEW PRINCIPLE OF PHILCO FABRICATED INSULATION*

Only PHILCO "THIRTY" has it!

Here is a brand-new construction principle *and* an ultra-modern application of a proven insulating material. Both the results of Philco pioneering! This material is fabricated glass tape wrapped around the positive plates in two layers, first vertically and then horizontally. Even a single layer of this glass tape insulation has been found to have better retentive power in holding the active material in the plate, than the standard glass mat! And—of course, the plates of the Philco "Thirty" are further protected and insulated with the time tested Philco slotted rubber retainer and rubber separator. **Patent applied for*

YOU GET IT FIRST WITH PHILCO



PROVED BY YEARS OF FIELD AND LABORATORY TESTS

As proved in scores of service tests, these unretouched photographs show what happens when a Philco "Thirty" cell (A) and a conventional type cell (B) are tested side by side in motive power cycle service, charged and discharged in series in the same circuit. Glass jars were used here only to permit observation. Note almost total absence of sediment in the Philco "Thirty", while the sediment space of cell B is filled. Cell B has delivered its normal life expectancy and is worn out—while the Philco "Thirty" still delivers over 100% of rated capacity, with a long margin of serviceable life still to go.

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A development for telephone, control and standby service, that materially increases battery room capacities.

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The battery that exerted a major influence on the wider use of full float service, by eliminating low cells. More efficient . . . more economical to maintain.

PHILCO HIGH CAPACITY CELLS

Through modern plate design, Philco showed the way to increased capacity without increase in over-all battery dimensions. A tremendous advantage in many motive power operations.

PHILCO

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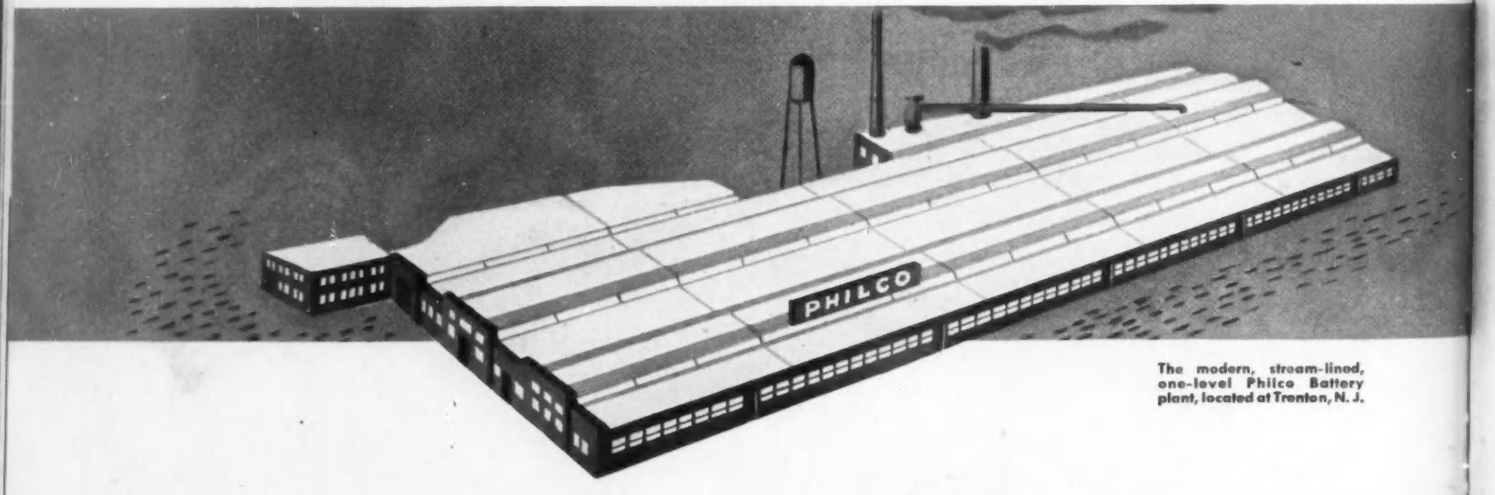
As described in the foregoing pages, Philco is ready, today, with the advanced battery performance and long-life economy you'll need in your post-war operations. With model manufacturing facilities, Philco is ready to produce these superior batteries in greater volume than ever before.

In the complete Philco line are modern storage batteries for all industrial applications—industrial trucks, mine locomotives and shuttle cars, diesel starting, railroad car lighting and air conditioning, control and power, telephone service and signal systems.

On your next purchase of batteries specify a modern Philco.



The modern, stream-lined, one-level Philco Battery plant, located at Trenton, N. J.

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These instruments combine time saving with accuracy, dependability and simplicity of operation. Whether used in large or small central offices they facilitate the handling of toll traffic.

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MAGNETO SWITCHBOARD

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A NEW STROMBERG-CARLSON MAGNETO SWITCHBOARD

The new Stromberg-Carlson No. 125 Magneto Switchboard is designed to give dependable service to magneto telephone exchanges. It features *economy, efficiency, speed,* and *adaptability.*

The CABINET is made of thoroughly kiln-dried oak with limed oak finish. Its flush design allows sections to fit together, presenting the appearance of one continuous switchboard when more than one section is installed.

The LOW HEIGHT KEYBOARD allows the operator to rest her feet naturally on the floor when working at the switchboard.

An interesting feature is provided by the new type LINE DROPS which operate on an unusually small amount of current. The JACK THIMBLE is separately removable from the front of the switchboard without interfering with the drops.

Efficiency of operating is increased by the DOUBLE RING-OFF SIGNALS which designate to the operator just which party to a connection has rung off.

The NON-RING-THRU CORD CIRCUITS eliminate confusion between subscribers and operators because a subscriber's ring-off signal cannot pass through one of these cord circuits to the connected line.

Maximum talking efficiency with minimum noise from inductive disturbances is assured as a result of the REPEATING COIL TYPE CORD CIRCUITS used throughout the switchboard.

CODE ALARM may be added on line drops when required.

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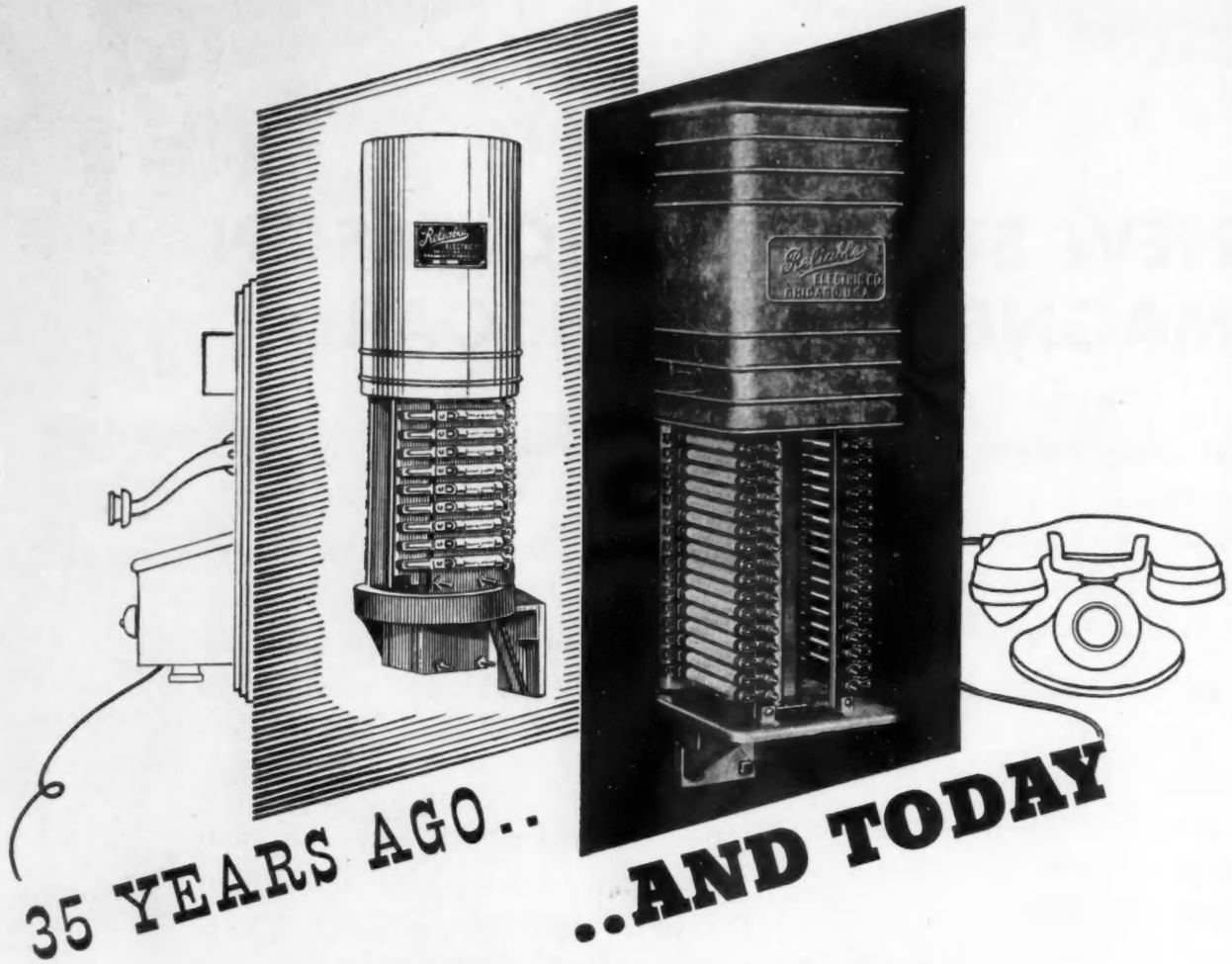

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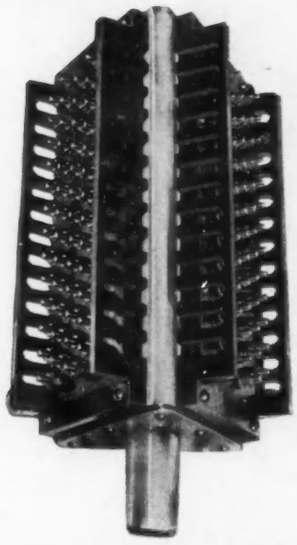
Little has been said about the engineering achievements and equipment improvements brought to the telephone industry by Reliable through the past 35 years. Cable trouble from lightning has been reduced; accidental grounding of lines due to discharge block dusting has been eliminated; service and maintenance of protective equipment has been simplified. This policy of steady improvement would be even more apparent today if the efforts of the research and testing departments could be divulged. Building protective equipment to stand abusive handling under extreme climatic conditions, Reliable is gaining experience to offer greater improvements in the future. Even under the present pressure of production for Victory, Reliable is maintaining quality and efficiency of performance in civilian equipment. Build for the future by specifying Reliable equipment.

RELIABLE ELECTRIC COMPANY

3145 CARROLL AVENUE · CHICAGO 12, ILLINOIS

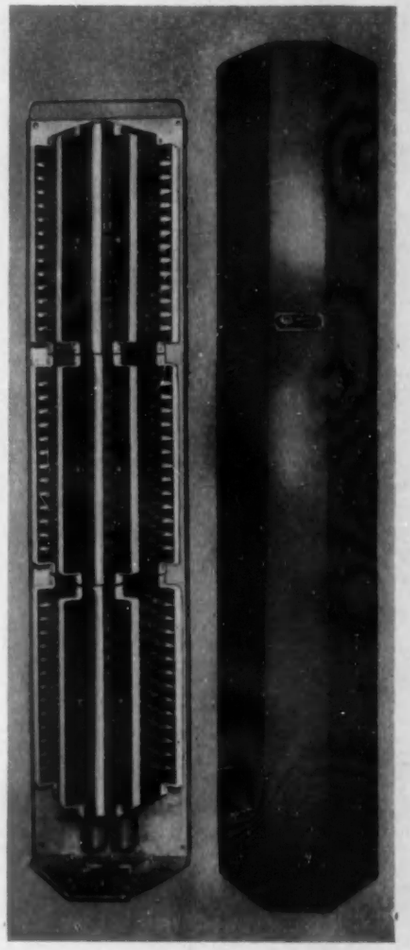
OVER THIRTY-FIVE YEARS SERVICE TO THE UTILITIES



UNIFLEX

CABLE TERMINALS

Extreme Flexibility for Terminating, Distributing, Looping and Cross-connecting Telephone Cables.



The Uniflex is the newest development of Cook engineers for providing the utmost in flexibility and space saving for terminating, distributing, testing and cross-connecting telephone cables. It is adaptable to a wide variety of uses and occupies only about one-half the space required by ordinary terminals, binding post chambers or pot heads formerly used for similar purposes.

Uniflex Cable Terminals, as the name implies, are built up of standard units which are combined to produce unprotected cable terminals for pole mounting in wood or metal pole houses or in Cook Terminal Vaults. The single frame units (26, 51 or 76 pairs) for outdoor use can be furnished with a regular cable terminal pole mounting bracket and hood.

The mass production economy of standard basic units and the ease and speed with which these units can be combined to furnish cable termination of almost any size and dimension offer unusual low cost initial investment, installation conveniences and flexibility. Uniflex Terminals are also ideally suited for mounting in pedestals for use in underground cable distribution systems.

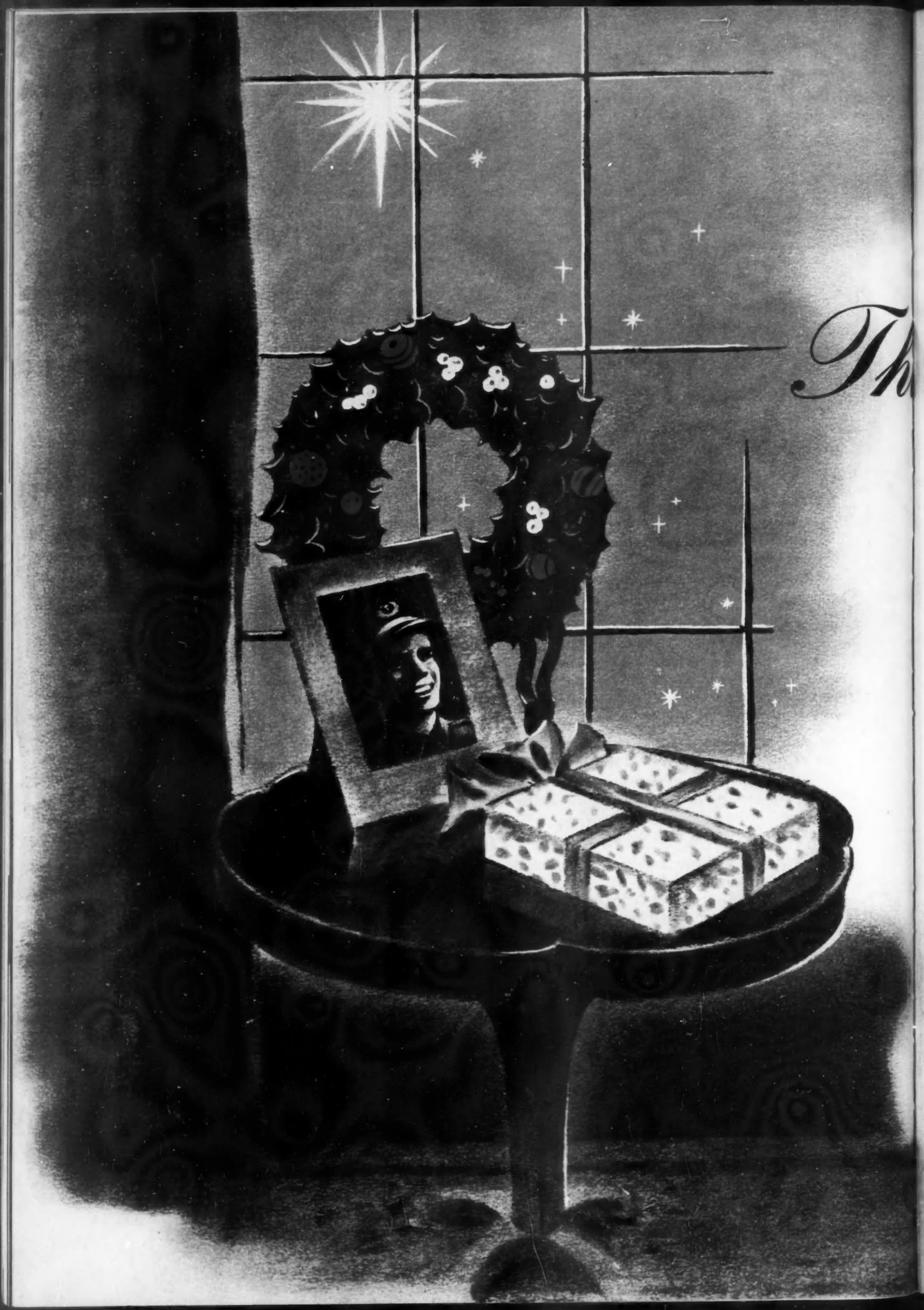
For complete description and diagrams of the Uniflex Cable Terminal assemblies, sizes and construction, see your Cook catalog. Keep a Cook catalog handy for ready reference for all Cook products. It's the best line for your line.

ARMY E NAVY

COOK ELECTRIC Company

Telephone Protection & Distribution Engineering Since 1897

2700 SOUTHPORT AVENUE • CHICAGO 14, ILLINOIS



The Clearing House

For the convenience of readers of Telephone Engineer

Good Used Switchboard Cable

No Preference Rating Required

6 pair	19 gauge	21 pair	22 gauge
6 pair	22 gauge	41 pair	22 gauge
11 pair	22 gauge	51 pair	22 gauge
16 pair	22 gauge		

COMBINATION

6 pair 22 gauge and 6 single 22 gauge
21 pair 22 gauge and 11 single 22 gauge
21 pair 22 gauge and 21 single 22 gauge
6 pair 19 gauge and 16 pair 22 gauge
11 pair 19 gauge and 11 pair 22 gauge
11 pair 19 gauge and 21 pair 22 gauge

Some tinned and some tinned enameled conductors, some acetate insulation but mostly silk and cotton, slate braid over all. Miscellaneous lengths. A few other types also on hand.

BUCKEYE TELEPHONE & SUPPLY COMPANY
COLUMBUS 6, OHIO

Notice Service Men

We are anxious to help returning war veterans to secure positions in the Independent telephone field and will run position wanted ads free of charge in TELEPHONE ENGINEER. Pass the good word along.

Help Wanted

TELEPHONE MEN WANTED —By Class A Company in Middle West. Experienced repairmen and linemen. Permanent position with good salary for men who can qualify. Furnish full details of experience, draft status, etc. Write Box 8347, c/o TELEPHONE ENGINEER.

WANTED: Telephone men for our Chicago factory. Steady work now and after the war, good wages and working conditions. To rebuild: telephones, magneto switchboards and dial switchboards. Telephone Repair & Supply Co., 1760 Lunt Ave., Chicago, Tel. ROGers Pk. 3818.

WANTED: By Telephone Co. in Middle West experienced repair man and lineman. Good salary for men who can qualify. Furnish full details of experience, draft status, etc. Statement of availability required. Write Box 8364, c/o TELEPHONE ENGINEER.

WANTED: Telephone Accountant—qualified to supervise all phases of telephone accounting for Class A companies. Give full information as to age, experience, draft status, etc. Attach small photograph. Telephone Services Inc., 16th Floor Lincoln Tower, Fort Wayne, Indiana.

WANTED: Lineman and Combination Installer Repairman by a telephone company located near Cincinnati, Ohio. In reply furnish complete information as to age, experience, draft status and starting wage. Address: Box 8366, c/o TELEPHONE ENGINEER.

WANTED: Cable Splicer. Splendid opportunity for an aggressive man to locate permanently in the winter resort section of North Carolina. Position available immediately. Wire or write: Central Carolina Telephone Co., Southern Pines, No. Car. "The Midsouth Resort."

FOR SALE: 500 used crossarms plain or treated. 10 Ft. standard 8 Pin Complete with pins and braces. Public Service Telephone Co., Montrose, Mich.

A NEW, IMPROVED— UNIQUE SPLICERS FURNACE

Melts 50 Lbs. of Solder in 10 Minutes

Basically the same fine furnace used by larger Utilities for 20 years - Now with

- **FINE FLAME CONTROL**—keeps solder at "just the right temperature."
- **"QUICK CHANGE" GENERATOR**—removed and replaced in 60 seconds.
- **WIND-PROOF** — housing shields generator — No extra shield is needed.

Additional Features: Long-life figure "8" generator—with orifice scraper. Rugged semi-steel top plate. Powerful pump. 16 gauge welded steel tank with bottom shock ring. Size 8" x 13". Weight—15 lbs. Popular size for 6", 7", and 8" pots.

No. 55-I—KEROSENE No. 53-I—GASOLINE

If clear white gasoline is hard to get, order the Kerosene Furnace. You'll like it.

We Invite An Appeal Test

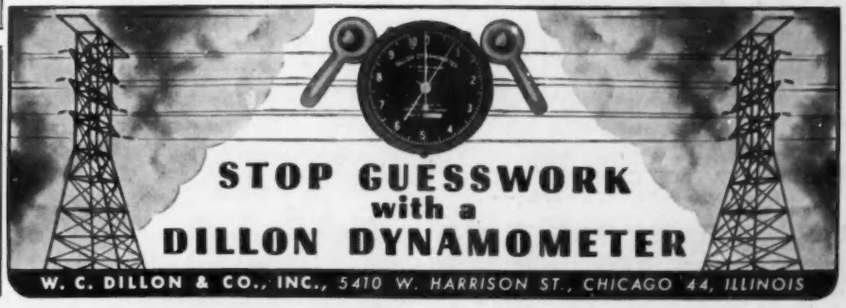
UNIQUE MANUFACTURING CO., INC.
231 W. Walton St., Chicago 10, Ill.

TELEPHONE DIRECTORY ADVERTISING

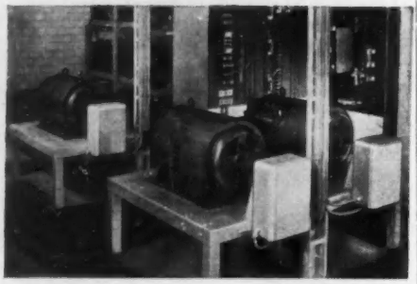
L. M. BERRY & CO.

Write or Telephone for Proposition

TELEPHONE L.D. 16
TELEPHONE BLDG., DAYTON, OHIO



Thru Its Automatically Controlled Safe, Continuous Floating Charge—



THE DIVERTER POLE MOTOR GENERATOR

Insures BEST Battery Performance At All Times

If a telephone exchange battery is to give maximum service life combined with high storage efficiency, it must be kept fully and properly charged. This means that the charger floating with the battery must stay actively on duty at all times providing a continuous, safe, controlled floating charge.

The inherent characteristics of the DIVERTER POLE GENERATOR definitely provide the essential requirements to insure this kind of service.

The DIVERTER POLE GENERATOR fully and completely Automatic; eliminates all manual attention of charging and requires only periodic inspection.

Specially designed, carefully constructed and thoroughly tested—it insures constant exchange voltage within very close limits, for 24 hour service—provides a safe continuous floating charge to the battery—protects itself against damaging overloads and is both electrically and mechanically quiet in operation.

Over thirty years of service in thousands of installations have proved beyond question the exceptional value of the DIVERTER POLE GENERATOR for a floating charge with Telephone Exchange Batteries. It will pay you to investigate.

DIVERTER POLE CONSTRUCTION
Write for Bulletin No. 96 Today—

The Electric Products Co.
1729 CLARKSTONE ROAD · CLEVELAND 12, OHIO

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AUTOMATIC ELECTRIC COMPANY

Takes License Under Patents Covering

NEW AUTOMATIC SYSTEM

Invented By Mr. F. R. McBerty
President, The North Electric Mfg. Co.

In 1940, there appeared in the telephone field a new and interesting mechanism, comprising the basic unit in a new line of automatic switchboards for dial telephone exchanges. Its inventor, Mr. F. R. McBerty, President of The North Electric Manufacturing Company, is highly regarded as one of the world's foremost designers of automatic switching systems and components, and from the early days of automatic telephony he has been a keen student of developments in that field. The new system which he has brought out is already serving exchanges ranging in size from 30 to 2300 lines, and is the first new automatic system to come into the market for many years which offers the possibility of lower manufacturing costs.

In pursuance of its long-established policy of maintaining its position of being able to supply the broadest possible range of telephone equipment which meets the requirements of sound engineering and operating economy, AUTOMATIC ELECTRIC COMPANY announces that it has taken a license under the patents issued to Mr. F. R. McBerty for this new system.

Automatic Electric Company's staff of electrical engineers, designers and consultants, with a background of experience unique among the world's telephone manufacturers, is engaged in a continuous program of research, development and improvement in the field of automatic switching. As a result, the Company has made available many types of switching equipment, including the following which have successfully met, for a period of many years, the varying exchange requirements and varying customer preferences throughout the world:

STROWGER AUTOMATIC TELEPHONE EQUIPMENT, with line apparatus consisting of Strowger Line Finders, Rotary Line Finders, Rotary Line Switches, or Plunger Line Switches.

STROWGER AUTOMATIC TELEPHONE EQUIPMENT, British Post Office Standard (Type 2000).

RELAY TYPE SYSTEMS, using Automatic Electric Relays, including the distinctive Rotor Relay.

The addition of the new system brought out by Mr. McBerty now places the Company in a still stronger position with respect to its ability to supply equipment to meet the preference of any customer. Operating companies are invited to consult with the Company's representatives in the selection of EQUIPMENT THAT WILL BEST MEET THEIR TRAFFIC AND SERVICE NEEDS.

AUTOMATIC ELECTRIC

Originators and Developers of Strowger Step-by-Step Machine Switching Automatic Dial Systems
Makers of Telephone, Signaling and Communication Apparatus . . . Electrical Engineers, Designers and Consultants

[illegible] S. and Possessions

AUTOMATIC ELECTRIC SALES CORPORATION, 1033 W. Van Buren St., Chicago 7, U. S. A.
Export Distributors: INTERNATIONAL AUTOMATIC ELECTRIC CORPORATION

NORTH TELEPHONES

INTERCHANGEABLE BASE INTRODUCES A 3-WAY SAVING

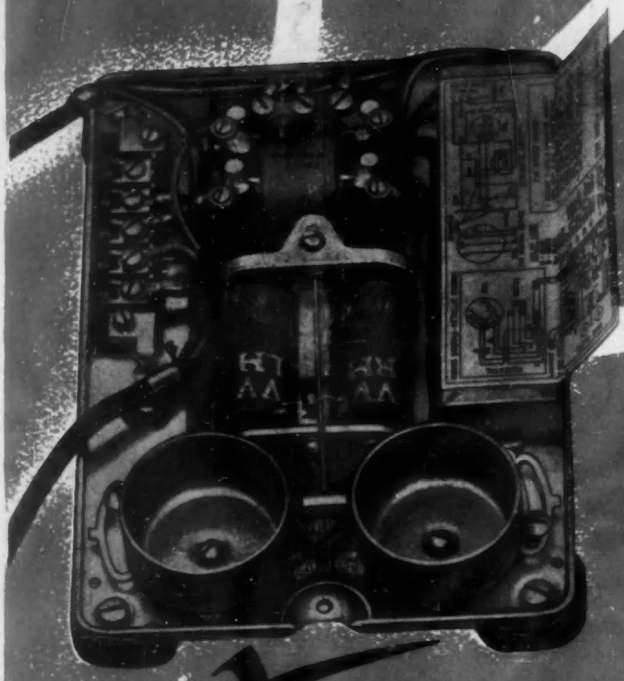
ONE — Eliminates large investments in complete telephone assemblies and separate ringer boxes.

TWO — Adaptability to magneto, common battery or dial automatic equipment keeps inventories at a minimum — equipment can be modernized without adding to telephone inventory.

THREE — Materially reduces unit telephone costs per subscriber.

The modern design of NORTH TELEPHONES is reflected in the handsome hand set shown above—a masterpiece of today with tomorrow's telephone requirements fully anticipated. It is mounted on NORTH'S interchangeable base.

Where the NORTH base must perform its duty as a separate ringer box, this cover (upper right) protects the dependable mechanism of the NORTH interchangeable base.



By giving distinction to the wall telephone set (right) NORTH has lifted it out of the commonplace. With the NORTH interchangeable base it becomes an independent unit.

Conversion from desk set to ringer box or wall set is effected by a simple interchange of inexpensive housings in accordance with subscribers' requirements.

THE NORTH ELECTRIC MFG. COMPANY • GALION, OHIO